Edition 07.2014 · 610.00260.40.000

Original operating instructions · English

Operating Instructions

2FC4...-1ST | 2FC4...-1PB | 2FC4...-1PN |
2FC4...-1SC | 2FC4...-1CB

Elmo Rietschle

G-Serie
G-Series
Seitenkanal
Side Channel

C-Serie
C-Series
Klaue
Claw

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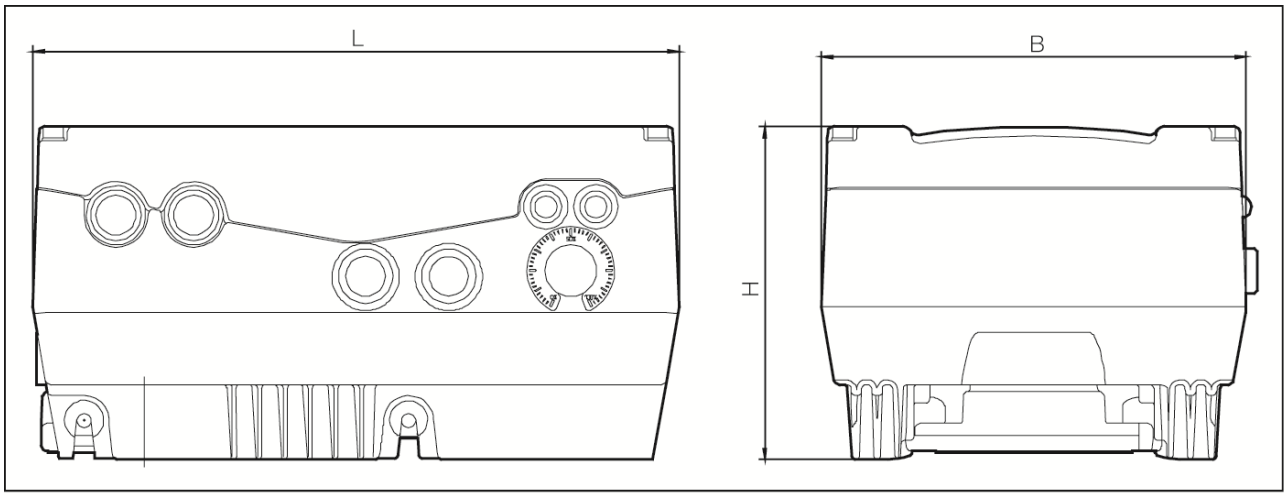
1 Overview of sizes



Dimensional drawings

The drive controls are available in the following performance classes with the specified size names.

Sizes

Sizes drive controls motor integrated	MA	MB	MC	MD
Recommended motor power [kW]	1.5	2.2 / 3.0 / 4.0	5.5 / 7.5	11.0 / 15.0 / 18.5 / 22.0
Dimensions L x B x H [mm]	233 x 153 x 120	270 x 189 x 140	307 x 223 x 181	414 x 294 x 232

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2.1 Storing the documentation

Store this manual and all other applicable documents safely so they are available as and when required.

Provide the operator of the system with this manual so it is available as and when required.

2.2 Explanation of the terms and symbols

In these instructions symbols and terms will be used to mean the following.

Symbol	Explanation
!	Requirement, pre-requisite
①	One-step handling instructions
1 2 3	Multi-step handling instructions
✓	Result
[→ 54]	Cross reference with page reference
	Additional information, tips
	Direction of rotation arrow
	Direction of conveyance arrow
	General warning sign (warns of risk of injury)
	Electrical voltage warning
	Hot surface warning
	Disconnect prior to maintenance or repair
	Observe the instructions
	Use foot protection
	Use hand protection
	Use eye protection
	Use head protection
	Use ear protection
	Earth prior to use

Term	Explanation
Plant	Part provided by the user in which the vacuum pump/compressor is installed.
Vacuum pump/compressor	Ready to connect machine for the generation of a vacuum and/or overpressure. The vacuum pump/compressor consists of a compressor part and motor, as well as other accessories where applicable.
Motor	Asynchronous motor for driving the vacuum pump/compressor.
Compressor	Mechanical part of the vacuum pump/compressor without motor.
Assembly environment	Space in which the vacuum pump/compressor is set up and operated (this may differ from the suction environment).
Drive control	Device for rotation speed control of the vacuum pump/compressor. The drive control can be mounted close to the motor (wall assembly) or integrated into the vacuum pump/compressor

2.3 Changes in comparison to the previous version

Amendments in comparison to version 05.2014

- 7.3.1 Basic parameter
  Parameter: 1.054; 1.131; 1.132; 1.150
- 7.3.3 Basic potentiometer
  Parameter: 2.150
- 7.3.8 Digital outputs
  Parameter: 4.150/4.107
- 7.3.9 Relay
  Parameter 4.190/4.210
- 7.3.10 External error
  Parameter: 5.010/5.011
- 7.3.12 Blocking detection
  Parameter: 5.090
- 7.4.7 Field bus (NEW)
- 8.1 Display of the LED flash codes for error detection
- 9.1 General data
- 11.4 Approval according to UL

2.4 Other valid documents

All instructions that describe the use of the drive control and if applicable, further instructions of all accessory parts used, e.g.

Document number	Purpose
—	Vacuum pump/compressor operating manual
610.00260.40.010 *	Operating manual 2FC4...-1PB **OR**
610.00260.40.020 *	Operating manual 2FC4...-1PN **OR**
610.00260.40.030 *	Operating manual 2FC4...-1SC **OR**
610.00260.40.040 *	Operating manual 2FC4...-1CB
610.00260.40.600 *	MMI hand-held unit operating manual

*according to the model option or accessories

Download of 3D files (.stp) for drive control and adapter plates under www.gd-elmorietschle.com.

To parameterise the drive control, the parameter description is ready to be downloaded (www.gd-elmorietschle.com). The download contains all necessary information for correct parameterisation.

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The manufacturer is not liable for damage caused by the failure to observe these instructions and the related documents [→ 6].

3.1 Explanation of warning signs

Warning sign	Explanation
⚠ DANGER	Danger that failure to observe the measures could lead to death or serious physical injuries.
⚠ WARNING	Danger that failure to observe the measures could lead to death or serious physical injuries.
⚠ CAUTION	Danger that failure to observe the measures could lead to minor physical injuries.
NOTICE	Danger that failure to observe the measures could lead to material damage.

3.2 Safety instructions

The following warnings, precautionary measures and comments are provided for your safety and serve to prevent damage to the drive control and the components connected to it. This chapter contains warnings and information that are generally applicable when handling drive controls. They are split into general information, transport and storage, start-up, operation, repairs and dismantling & disposal.

Specific warnings and comments that apply to specific activities can be found at the start of the appropriate chapters and are repeated and added to at various critical points in these chapters.

Please read this information carefully as it is provided for your personal safety and will also prolong the life of the drive control and connected devices.

3.2.1 General information

⚠ WARNING

This drive controller carries dangerous voltages and controls rotating mechanical parts which may be dangerous!
Disregarding the warnings or failure to follow the instructions contained in this manual may lead to death, serious bodily injury or substantial property damage.

① Only qualified personnel should work on this drive controller. These personnel must be thoroughly familiar with all safety instructions, installation, operation and maintenance procedures contained in this manual. The smooth and safe operation of the drive controller depends on proper handling, installation, operation and maintenance.

⚠ WARNING

Risk of fire or electric shock!
Improper use, modifications and the use of spare parts and accessories that are not sold or recommended by the manufacturer of the drive controller can cause fire, electric shock and bodily injury.

① The cooling element of the drive controller and motor can reach temperatures of above **70°C** [158 °F]. During installation, sufficient spacing between adjacent components should be maintained. Before working on the drive controller or motor, required cooling time must be ensured. If necessary, a protection against accidental contact should be installed.

NOTICE

The drive controller may be operated safely only if the required ambient conditions are met, see Suitable ambient conditions [→ 15].

NOTICE

This operating manual must be kept in the vicinity of the equipment, so as to be readily accessible to all users.

NOTICE

Please read these safety instructions and warnings carefully and all the warning labels attached to the equipment before installing and commissioning. Make sure that the warning labels are kept in a legible condition and replace missing or damaged labels.

3.2.2 Transport and Storage

NOTICE

Risk of damage to the drive controller!
The drive controller can be damaged in the case of non-compliance with the instructions and destroyed during subsequent handling.

① The smooth and safe operation of this drive controller requires proper mounting, installation and assembly as well as careful operation and maintenance. The drive controller must be protected during transport and storage against mechanical shocks and vibration. The protection against excessive temperatures (see Technical data [→ 64]) must be guaranteed.

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3.2.3 Commissioning

⚠ DANGER

Risk of injury due to electric shock!
The non-observance of warnings can result in severe bodily injury or substantial property damage.

1. Only hard-wired grid connections are permitted. The device must be earthed (DIN EN 61140; VDE 0140-1).
2. The drive controls may have contact currents > 3.5mA. According to DIN EN 61800-5-1 chapter 4.3.5.5.2, an additional protective earth conductor with the same cross section as the original earth conductor must be attached. The possibility of connecting a second protective earth conductor is located underneath the power supply (with marked ground symbol) on the outside of the device. For the connection, a suitable M6x15 screw (torque: **4.0 Nm** [2.95 ft lbs]) is included in the scope of delivery of the adapter plates.
3. When using alternating current drive controls, conventional FI circuit breakers of type A, also known as RCDs (residual current-operated protective devices) are not permitted for the protection of direct or indirect contact! As per DIN VDE 0160, section 5.5.2 and EN 50178, section 5.2.11.1, the FI circuit breaker (RCD type B) must be suitable for all types of current.
4. The following terminals can also lead to dangerous voltages when the engine is at a standstill:
   - ✓ the mains connection terminals X1: L1, L2, L3
   - ✓ the motor connection terminals X2: U, V, W
   - ✓ the connection terminals X6, X7: Relay contacts relays 1 and 2
   - ✓ the PTC connection terminals T1/T2
5. When using different voltage levels (e.g. +24V/230V), always ensure that lines do not cross! Furthermore, the operator must ensure that the applicable regulations are adhered to (e.g. doubled or reinforced insulation according to DIN EN 61800-5-1).
6. The drive control contains electrostatically sensitive assemblies. These assemblies can be destroyed due to improper handling, therefore safety measures against electrostatic loading must be adhered to when work must be done on these assemblies.

3.2.4 Operation

⚠ DANGER

Risk of injury from electric shock or restarting motors!
The non-observance of warnings can result in severe bodily injury or substantial property damage.

① Observe the following instructions during operation:

- ✓ The drive controller operates at high voltages.
- ✓ When operating electrical equipment, certain parts of the equipment carry dangerous voltage.
- ✓ Emergency stop devices according to EN 60204-1:2006 must remain operative in all operating modes of the control unit. Resetting the emergency stop device must not lead to uncontrolled or undefined restart.
- ✓ Safe disconnection from the mains requires synchronous and all-pole disconnection of the mains supply line to the drive controller.
- ✓ For devices with single-phase supply and for the BG D (11 to 22 kW), at least 1 to 2 min break should be kept between successive connections to the mains.
- ✓ Certain parameter settings may cause the drive controller to restart automatically after a power failure.

NOTICE

Risk of damage to the drive controller!
The drive controller can be damaged in the case of non-compliance with the instructions and destroyed during subsequent handling.

1. Observe the following instructions during operation:
2. For a functioning motor overload protection, the motor parameters must be configured correctly.
3. Ensure the motor overload protection via a PTC. In addition, the drive control provides an internal motor protection. See also parameter 33.100 and 33.101. According to the presetting, the I^2T is OFF and must be activated during operation without PTC.
4. The drive controller must not be used as an 'emergency stop device' (see EN 60204-1:2006).

3.2.5 Maintenance and inspection

Maintenance and inspection of the drive controllers must be performed only by electrically certified, qualified person. Changes in hardware and software, unless explicitly described in this manual, may only be performed by the manufacturer.

Cleaning the drive controllers

The drive controllers are maintenance-free when operated properly. In a dusty environment, the cooling ribs on the motor and the drive controller must be cleaned regularly. For equipment that are equipped with integrated fans, option for BG C, series in BG D, cleaning with compressed air is recommended.

Measurement of insulation resistance on the control unit

Insulation test at the input terminals of the control card is not permitted.

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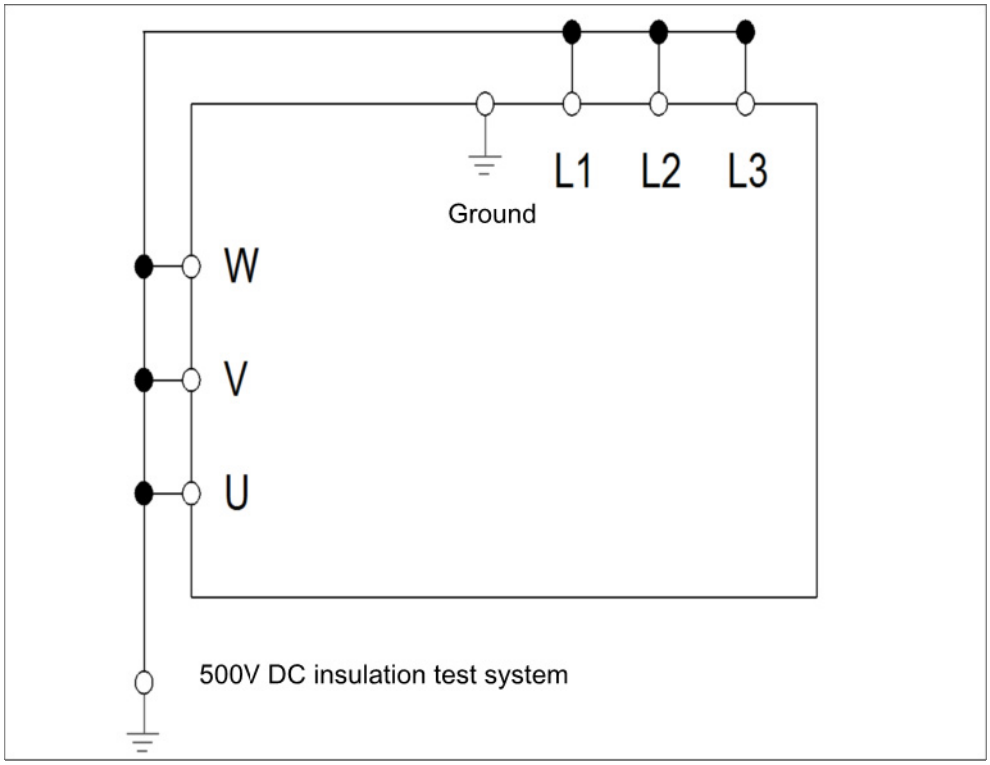
Measurement of insulation resistance on the power unit

In the course of the series testing, the power unit of the drive controller is tested by applying 1.9 kV.

Should the measurement of insulation resistance be necessary in a system check, then this can be carried out under the following conditions:

- an insulation test can be performed only for the power unit,
- to avoid impermissible high voltages, all connecting cables of the drive controller must be disconnected prior to the test,
- a 500 V DC insulation tester is used.



Insulation test on the power unit

Pressure test on a DRIVE CONTROLLER

A pressure test of the drive controller is not allowed.

3.2.6 Repairs

⚠ DANGER

Danger of injury through electric shock!
Non-observance of warnings may result in serious injury or damage.

① When the drive control is disconnected from the mains voltage, live device parts and connections may not be touched immediately in case the condensers are still live.

NOTICE

Risk of damage to the drive control!
If the information is not observed, the drive control could be damaged and destroyed during subsequent start-up.

① Repairs to the drive control may only be performed by the manufacturer.

3.2.7 Disassembly and Disposal

Screw and snap-on connections are easy to release and allow the drive control to be dismantled into its individual parts. These parts can be sorted for recycling. Please comply with local regulations during disposal.

Components with electronic parts may not be disposed of along with normal household waste. They have to be collected separately with used electrical and electronic equipment in accordance with applicable legislation.

3.3 Correct use of the equipment

During installation in machinery, commissioning of the drive controller (i.e. starting of intended operation) is prohibited until it is proven that the machine complies with the regulations of the EC Directive 2006/42/EC (Machinery Directive); EN 60204-1:2006 is to be observed.

Commissioning (i.e. starting of intended operation) is only permitted if the EC Directive 2004/108/EC (EMC Directive) allows it.

The harmonised standards of the series EN 50178:1997 in conjunction with EN 60439-1/A1:2004 shall be applied to this drive controller.

This drive controller is not approved for operation in potentially explosive areas!

Repairs may only be carried out by authorised repair workshops. Unauthorised interventions can lead to death, bodily injury and property damage. The warranty provided by the manufacturer expires in this case.

External mechanical loads, such as stepping on the casing are not allowed!

The use of the drive units in non-stationary equipment is considered as unusual environmental conditions, and is permitted only in accordance with the locally applicable standards and guidelines.

3.4 Staff qualifications and training

All those who will work with the 2FC4 must have read and understood these instructions and the related documents [→ 6].

Personnel in training may only work with the 2FC4 under supervision of personnel who have the **required knowledge**.

Only personnel with the following knowledge may carry out the work described in these instructions:

Qualified personnel, as understood in these operating instructions and product labels, are qualified electricians who are familiar with the installation, assembly, commissioning and operation of the drive controller, as well as the risks associated therewith and have the respective skills on account of their professional training and knowledge of the relevant standards.

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3.5 Requirements of the operator

As a basic principle, electronic devices are not fail-proof. The operator and/or the contractor setting up the machine or system is responsible for ensuring that the drive switches to a safe state if the device fails.

The “Electrical equipment of machines” section in EN 60204-1, “Safety of machinery” describes the safety requirements for electrical control units. These are provided for the safety of people and machines and must be observed in order to retain the functional capability of the machine or system.

An emergency stop feature does not have to result in the power supply to the drive being switched off. To avoid dangerous situations, it may be useful for individual drives to remain operational or for specific safety procedures to be initiated. The effectiveness of emergency stop measures is evaluated by means of a risk assessment for the machine or system and its electrical equipment, and is determined by selecting a circuit category according to EN 13849 “Safety of machinery – Safety-related parts of control systems”.

The operator ensures that:

- All work on the 2FC4 is carried out by:
  - personnel that have the necessary Staff qualifications and training [→ 12]
  - personnel that have been sufficiently informed of these instructions and all related documents [→ 6]
- Assignment, responsibility and supervision of personnel is regulated.
- The content of these and locally applicable instructions are always available to personnel.
- All local and plant-specific safety measures are adhered to, such as:
  - Prevention of accidents
  - safety and operating regulations
  - Utility company regulations
  - Standards and laws
- Dangers due to electrical energy are not possible.

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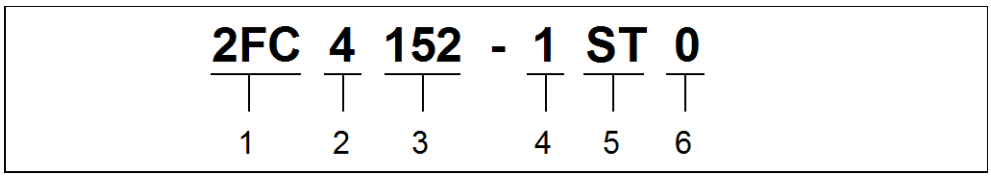
4.1 Model description



Item designation

1 **2FC** = drive control

2 Connection voltage:
4 = 400 V -15% — 480 V +10%

3 Performance:
152 = 1.5 kW
222 = 2.2 kW
302 = 3.0 kW
402 = 4.0 kW
552 = 5.5 kW
752 = 7.5 kW

4 Type of assembly:
1 = integrated drive control

5 Version:
ST = Standard
PB = Profibus
PB = Profinet
SC = Sercos III
CB = CANopen

6 reserved:
0 = Standard

4.2 Description of the drive control

The drive control is a device for speed control in three-phase AC motors.

The drive control can be integrated in the motor (with the standard adapter plate) or fitted close to the motor (with the wall installation adapter plate).

The permitted ambient temperatures specified in the technical data refer to operation at nominal load. In many cases, higher temperatures may be permitted after a detailed technical analysis. These have to be approved by manufacturer on a case-by-case basis.

4.3 CE marking

With the CE marking, we, as the manufacturer of the device, confirm that the drive control meets the basic requirements of the following guidelines:

- Directive on Electromagnetic Compatibility (Directive 2004/108/EC)
- Low Voltage Directive (Directive 2006/95/EC)

You can download the declaration of conformity from www.gd-elmorietschle.com.

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5.1 Safety instructions for installation

⚠ WARNING

1. Installation may only be performed by appropriately qualified employees who are trained in the set-up, installation, start-up and operation of the product. Work performed on the drive control by unqualified staff and non-observance of warnings may result in serious injury or damage.
2. The device must be grounded in accordance with EN 61140, NEC and other relevant standards. Mains connections must be hardwired.

5.2 Installation requirements

5.2.1 Suitable ambient conditions

Ambient conditions

Height of the installation place:	Up to **1000 m above NHN** [3280 ft above NHN]/above **1000 m** [3280 ft] at reduced performance (1% per **100 m** [328 ft]) max. **2000 m** [6560 ft], see
Ambient temperature:	**-25°C** [-13°F] up to **+50°C** [122°F] (deviating ambient temperatures are possible in individual cases) , see
Relative humidity:	≤ 96%, condensing not permitted
Vibration- and shock resistance:	EN 60068-2-6 severity level 2 (vibration transport) EN 60068-2-27 (vertical impact test) 2...200 Hz for sinusoidal oscillation
Electromagnetic compatibility:	interference-resistant according to EN 61800-3
Cooling:	Surface cooling: sizes A to C: free convection; size D: with integrated fans

! Make sure that the housing design (protection type) is suitable for the operating environment:

1. Make sure that the seal between motor and adapter plate is inserted correctly.
2. All unused threaded cable glands should be sealed.
3. Check that the cover of the drive controller is closed and bolted down tightly.

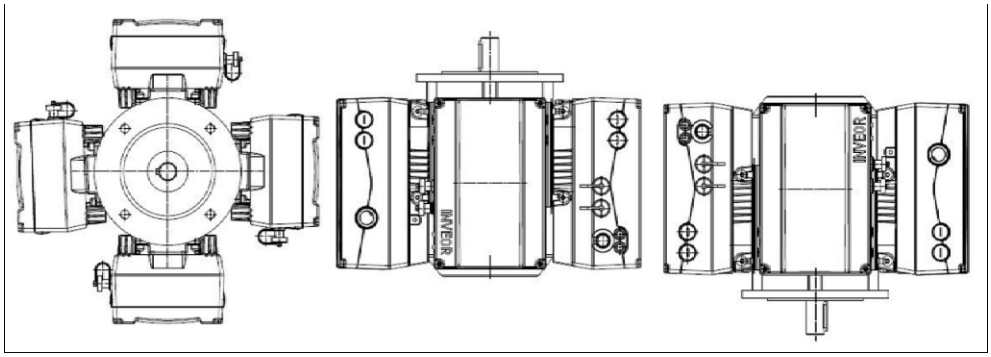
Subsequent varnishing of the drive controller is principally feasible, however, the operator must test the varnish to be used for material compatibility! Failure to comply may result in long term loss of protection type (in particular, for seals and light drawbars)! The drive controllers are available in the colour RAL 9005 (black).

The warranty claim expires in the event of dismantling circuit boards (also for the purpose of varnishing or coating the housing components)!

Mounting points and sealing surfaces must be basically kept varnish-free for EMC- and earthing reasons.

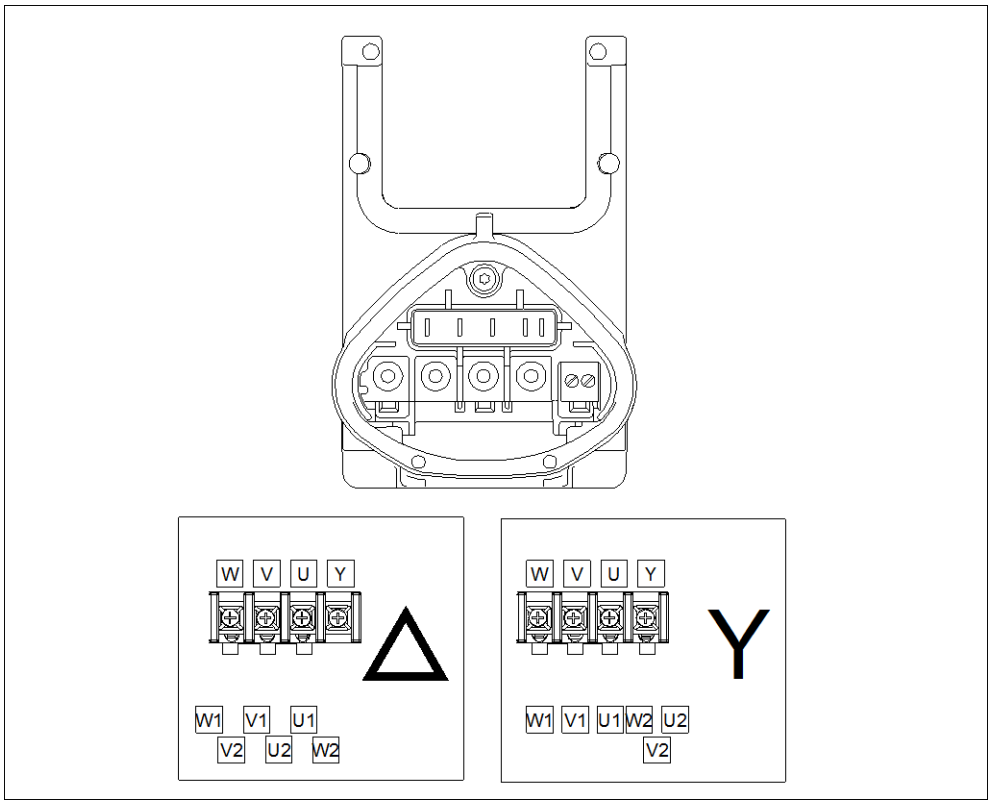
5.2.2 Suitable installation location for the motor-integrated drive control

① Ensure that the motor with a motor-integrated drive control is only installed and operated if aligned as shown in the following diagram.



Motor installation location/permitted alignments

5.2.3 Basic connection variations



Star or delta connection with the drive controller integrated in the motor

NOTICE
Risk of damage to the drive controller! **When connecting the drive controller, the correct phase sequence must be adhered to; otherwise, the motor can be overloaded.** ① Thus, the correct phase sequence should be ensured when connecting the motor.

With the supplied installation material, wire-end sleeves and cable lugs can be connected. The connection options are shown in Figure 4.

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Unused open cable ends in the motor connection box must be insulated.

If a PTC or Klixxon is used, the jumper, seated in the terminal for the PTC in the delivery condition, must be removed.

The cross section of the mains supply line should be designed according to the type of wiring and the max. current allowed. The mains supply protection must be ensured by the system start-up engineer.

5.2.4 Short-circuit and earth-fault protection

The drive controller has an internal short-circuit and earth-fault protection.

5.2.5 Wiring instructions

The control terminals of the application card are located inside the drive controller.

Depending on the version, the pins may be allocated differently.

Terminals:	Plug-in terminal connector with actuating pusher (slot-head screwdriver, max. width **2.5 mm** [0.098 in])
Connection cross-section:	**0.5 to 1.5 mm**^{2} (0.02 to 0.06 inch^2), single wire, AWG 20 to AWG 14
Connection cross-section:	**0.75 to 1.5 mm**^{2} (0.03 to 0.06 inch^2), fine-wired, AWG 18 to AWG 14
Connection cross-section:	**0.5 to 1.0 mm**^{2} (0.02 to 0.04 inch^2), fine-wired (wire-end sleeves with and without plastic collar)
Wire stripping length:	**9 to 10 mm** (0.35 – 0.40 inch)

The terminals for the mains supply line are within the drive controller. The drive controller is fitted with terminals for connecting a braking resistor.

Depending on the version, the pins may be allocated differently.

Wire-end sleeves with plastic collar and lugs are recommended.

Terminals:	Spring-loaded contact (slot-head screwdriver, max. width **2.5 mm** [0.098 in])
Connection cross-section:	rigid **0.2 to 10 mm**^{2}, (0.008 – 0.4 inch^2) flexible wire **0.2 to 6 mm**^{2} (0.008 – 0.24 inch^2)
Connection cross-section:	**0.25 to 6 mm**^{2} (0.01 to 0.24 inch^2) (wire-end sleeves without plastic collar)
Connection cross-section:	**0.25 to 4 mm**^{2} (0.01 to 0.16 inch^2) (wire-end sleeves with plastic collar)
Connection cross-section:	**0.25 to 1.5 mm**^{2} (– 0.06 inch^2) for 2 conductors with the same cross section (twin wire-end sleeves with plastic collar)
Wire cross-section:	AWG 24 to AWG 8
Wire stripping length:	**15 mm** [0.6 inch]
Installation temperature:	**+5°C to +100°C** [41 – 212°F]

5.2.6 Preventing electromagnetic interference

For control circuits shielded cables must be used, where possible. At the cable end, the shield should be applied with due care without leaving the wires unshielded over longer distances.

The shielding of analogue setpoints should only be applied on one side of the drive controller.

Basically, the control wires should always be routed as far away as possible from power cables; separate cable ducts may have to be used, if required. If lines cross, an angle of 90° should be adhered to, where possible.

Upstream circuit elements, such as contactors and brake coils or circuit elements which are connected across the outputs of the drive controllers must be suppressed in terms of interference. In AC contactors, RC (resistor-capacitor) circuits can be used; suppressor diodes or varistors can be normally used for DC contactors. This interference suppressor is attached directly to the contactor coil. Basically, the power supply to a mechanical brake should not be routed in the same cable!

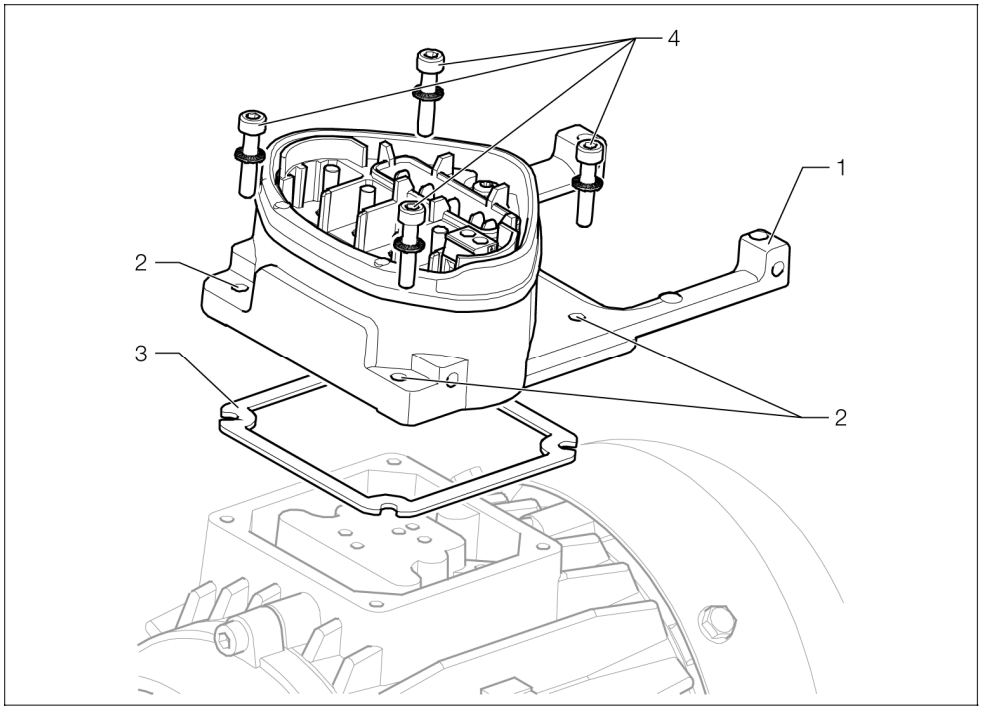
Power connections between the drive controller and motor should always be used in shielded or reinforced design and the shield must be earthed at both ends over a large area! The use of EMC cable glands is recommended. These are not included in the delivery.

5.3 Installation of the drive controller integrated in the motor

5.3.1 Mechanical installation of sizes A - C

For mechanical installation of the drive controller, proceed as follows:

1. Open the standard motor connection box.
2. Disconnect the wires to the terminals. Remember or write down the connection sequence.
3. If necessary, remove the motor terminal block.
4. Remove the fastening screws securing the housing and remove the housing. Be careful not to damage the gasket.



Assembly sequence: Junction box - adapter plate (BG A - C)

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The standard adapter plate is an adapter plate whose lower part has not been refinished. No holes are drilled.

① For the motors supplied, you can order adapter plates from the manufacturer.

5. Adjust them to the adapter plate (1) by drilling appropriate holes (2) in them for attachment to the motor.

The system start-up engineer is responsible for maintaining the protection class for the gasket of the adapter plate on the motor.

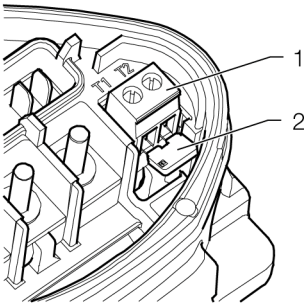
① For questions, please contact your sales representative.

6. Insert the gasket (3).
7. Lead the motor connection cable through the adapter plate while bypassing the terminal and screw the adapter plate onto the motor using four fastening screws and four spring elements (4) (torque: **2.0 Nm** [1.48 ft lbs]).

when mounting the adapter plates, ensure that all four screws, including the spring elements are tightened by applying the correct torque! All contact areas must be dirt/ paint-free, as correct protective earth connection cannot be ensured otherwise.

8. Connect the motor wires to the required interconnection, see also Figure 5 (Torque: **3.0 Nm** [2.21 ft lbs]). We recommend using insulated M5 ring terminals, with a connection cross-section of **4-6 mm**^{2} [0.16 to 0.24 inch^2]

When installing the motor wires make sure that all bolts on the adapter board are fitted with the enclosed nuts, even if the neutral point is not connected.



Jumper

9. Wire any available connection cable of the Motor PTC/ Klixxon to terminals T1 and T2 (1) (torque: **0.6 Nm** [0.44 ft lbs]).

when installing, make sure that the connection cables are not pinched.

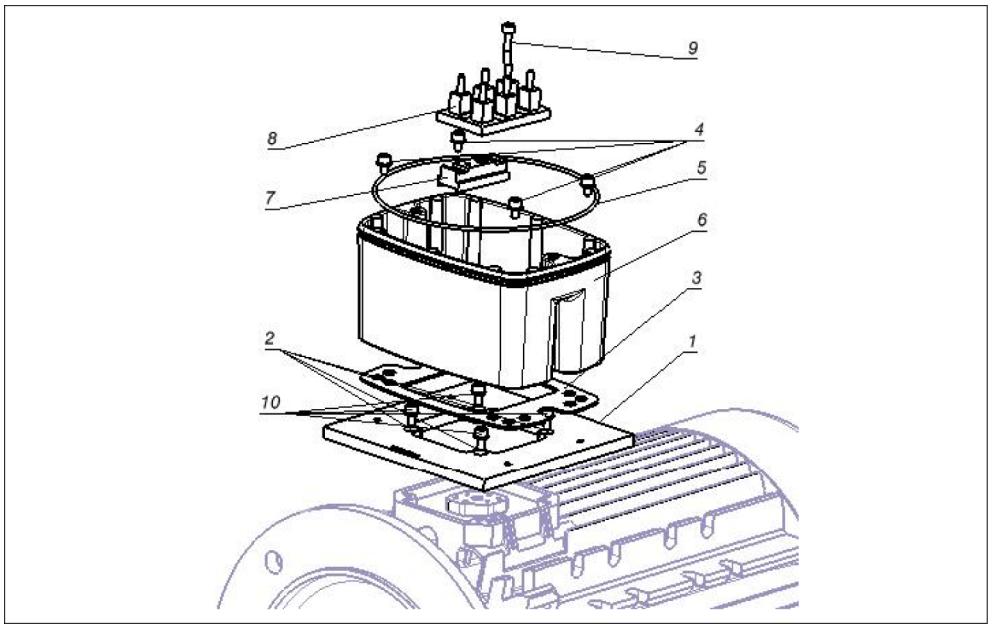
If the motor is equipped with a temperature sensor, it is connected to terminals T1 and T2 (1) and the jumper (2) included in the delivery must be removed. If the jumper is used, there is no temperature monitoring of the motor!

10. Plug the drive controller to the adapter plate and secure it evenly using the four screws at the side (torque: **4.0 Nm** [0.3 ft lbs]).

5.3.2 Mechanical installation of size D

For mechanical installation of the drive controller, proceed as follows:

1. Open the standard motor connection box.
2. Remove the fastening screws securing the housing and remove the housing. Be careful not to damage the gasket.



Assembly sequence: Junction box - adapter plate (BG D)

1	Adapter plate option (variant)	6	Support the drive controller / adapter plate
2	Motor-dependent holes	7	Terminal board expansion option
3	Seal	8	Original terminal board (not included in the delivery)
4	Fastening screws with spring elements	9	Elongated screw option (for 7)
5	O-ring- gasket	10	Fastening screws with spring elements option

The standard adapter plate is an adapter plate whose lower part has not been refinished. No holes are drilled.

① For the motors supplied, you can order adapter plates from the manufacturer.

3. Adjust them to the adapter plate (1) by drilling appropriate holes (2) in them for attachment to the motor.

The system start-up engineer is responsible for maintaining the protection class for the gasket of the adapter plate on the motor.

① For questions, please contact your sales representative.

4. Insert the gasket (3).
5. Screw the adapter plate onto the motor using the four fastening screws and the four spring elements (10) (torque: M4 with **2.4 Nm** [1.77 ft lbs], M5 with **5.0 Nm** [3.70 ft lbs], M6 with **8.5 Nm** [6.27 ft lbs]).

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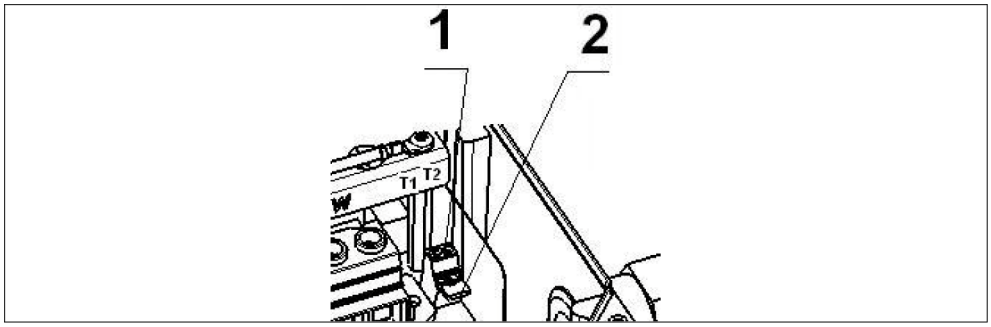
when mounting the adapter plates, ensure that all four screws, including the spring elements are tightened by applying the correct torque! All contact areas must be dirt/ paint-free, as correct protective earth connection cannot be ensured otherwise.

6. Reattach the original terminal board (8) to the motor, possibly with the aid of the terminal board expansion option (7) and the elongated screw option (9).
7. Connect four wires (PE, U, V, W) with the appropriate cross section (depending on the output of the drive controller used) to the original terminal board.

The connecting wires required for wiring the motor terminal board/ drive controller are not include in the delivery in the case of spare parts.

8. Screw the support (6) onto the adapter plate using the four fastening screws with spring elements (4). Please pay attention to the proper seating of the gasket (5). Insert the four wires (PE, U, V, W) into the support of the drive controller.
9. Plug the drive controller onto the support (6) and secure it evenly using the two M8 screws
   (torque: max. **21.0 Nm** [15.5 ft lbs]).



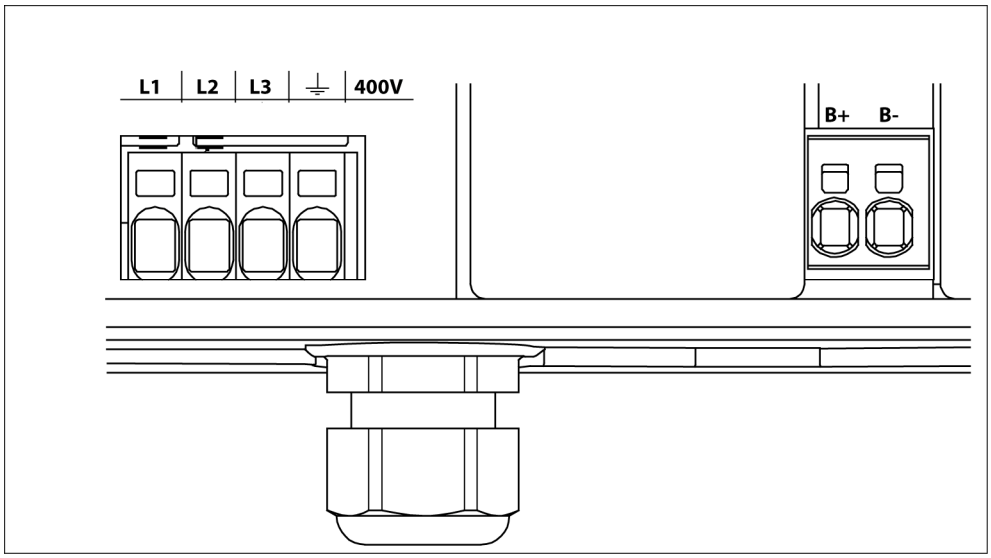
Jumper

10. Wire any available connection cable of the Motor PTC/ Klixxon to terminals T1 and T2 (1) (torque: **0.6 Nm** [0.44 ft lbs]).

when installing, make sure that the connection cables are not pinched.

If the motor is equipped with a temperature sensor, it is connected to terminals T1 and T2 (1) and the jumper (2) included in the delivery must be removed. If the jumper is used, there is no temperature monitoring of the motor!

5.3.3 Power connection of sizes A - C



Power connection BG A - C

1. Unscrew the four screws from the housing cover of the drive controller and remove the cover.
2. Run the mains cable through the threaded cable gland and connect the phases with the contacts L1, L2, L3 for 400 V and the buried cable with the PE contact on the terminal. The threaded cable gland provides cable relief, the PE connection line must be connected as a leading contact (significantly longer)!

When connecting a braking resistor to an optional brake module, shielded and double-insulated cables must be used.

3 ~ 400 V terminal assignment X1

Terminal no.	Designation	(Terminal) assignment
1	L1	Mains phase 1
2	L2	Mains phase 2
3	L3	Mains phase 3
4	PE	Buried cable

DC supply 250 to 750 V terminal assignment X1

Terminal no.	Designation	(Terminal) assignment
1	L1	DC network (+) (565V)
2	L2	Not assigned.
3	L3	DC network (-)
4	PE	Buried cable

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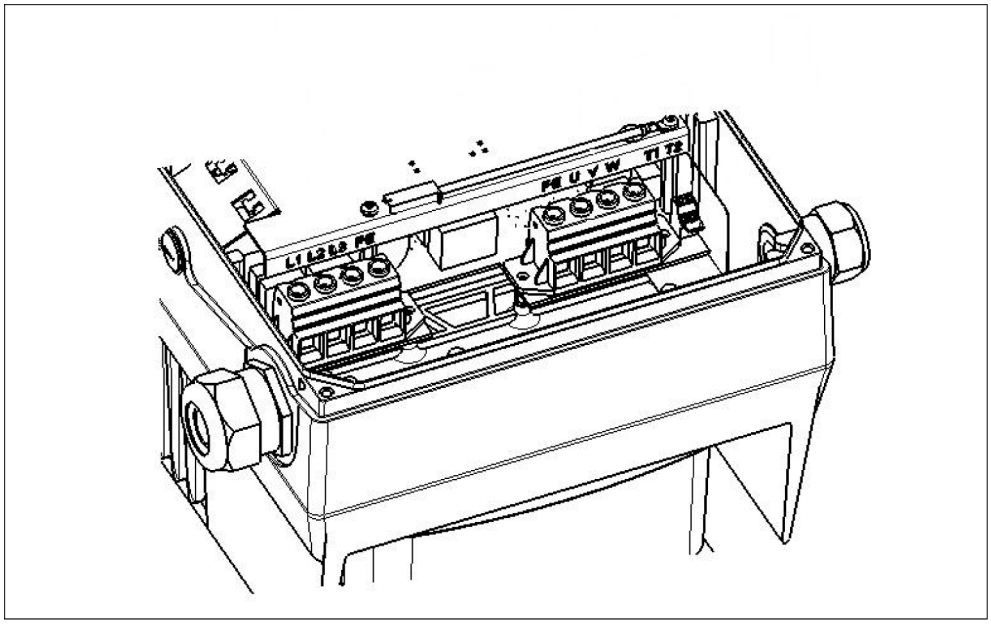
5.3.4 Power connection of size D



Power connection BG D

1. Unscrew the four screws from the housing cover of the drive controller and remove the cover.
2. Run the mains cable through the threaded cable gland and connect the phases with the contacts L1, L2, L3 for 400 V and the buried cable with the PE contact on the terminal. The threaded cable gland provides cable relief, the PE connection line must be connected as a leading contact (significantly longer)!

When connecting a braking resistor to an optional brake module, shielded and double-insulated cables must be used.

3 ~ 400 V terminal assignment X1

Terminal no.	Designation	(Terminal) assignment
1	L1	Mains phase 1
2	L2	Mains phase 2
3	L3	Mains phase 3
4	PE	Buried cable

DC supply 250 to 750 V terminal assignment X1

Terminal no.	Designation	(Terminal) assignment
1	L1	DC network (+) (565V)
2	L2	Not assigned.
3	L3	DC network (-)
4	PE	Buried cable

Motor terminal assignment X4

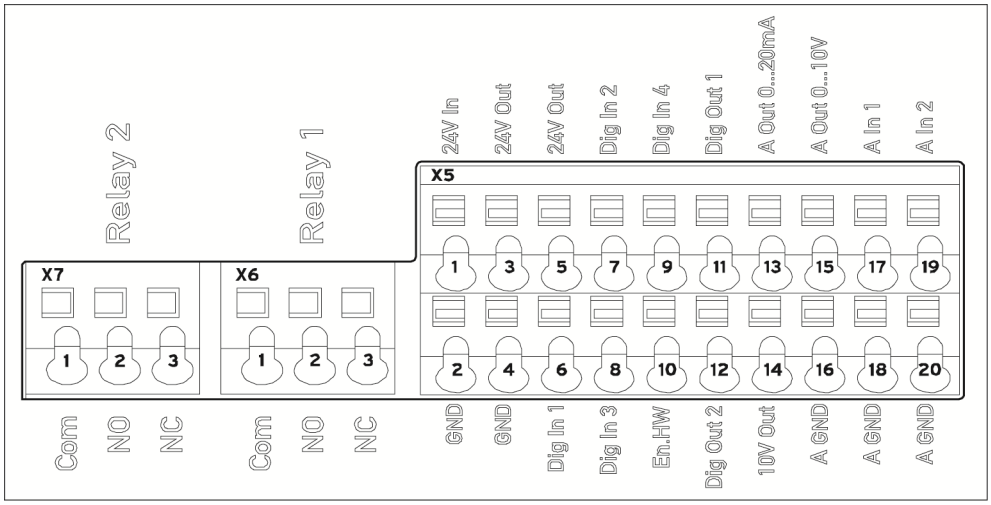
Terminal no.	Designation	(Terminal) assignment
1	PE	Buried cable
2	U	Motor phase 1
3	V	Motor phase 2
4	W	Motor phase 3

5.3.5 Connections for braking resistor

Terminal assignment for braking chopper

Terminal no.	Designation	(Terminal) assignment
1	B+	Connection of braking resistor (+)
2	B-	Connection of braking resistor (-)

5.3.6 Control terminals



Control terminals of the standard application card

NOTICE

Risk of coupling of external signals!

① Use shielded control wires.

1. Pass the required control wires through the threaded cable glands into the housing.
2. Connect the control wires according to the picture and/or table. To do this, use shielded control wires.
3. Put the lid on the housing of the drive controller and screw it in place.

Terminal assignment X5 of the standard application card

Terminal no.	Designation	(Terminal) assignment
1	24 V In	External power supply
2	GND (Ground)	Ground
3	24 V Out	Internal power supply
4	GND (Ground)	Ground
5	24 V Out	Internal power supply
6	Dig. In 1	fixed frequency 1/3 (parameter 1.100)
		Software release (parameter 1.131)
7	Dig. In 2	fixed frequency 2/3 (parameter 1.100)
8	Dig. In 3	Fault reset (parameter 1.180)
9	Dig. In 4	External error (parameter 5.010)
10	En -HW (release)	Hardware release
11	Dig. Out 1	Ready (parameter 4.150)
12	Dig. Out 2	Operation (parameter 4.170)
13	A. Out 0 ... 20 mA	Actual frequency value (parameter 4.100)
14	10 V Out	For external voltage divider

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Terminal no.	Designation	(Terminal) assignment
15	A. Out 0 ... 10 V	Actual frequency value (parameter 4.100)
16	A GND (Ground 10 V)	Ground
17	A. In 1	External Setpoint source (parameter 1.130)
18	A GND (Ground 10 V)	Ground
19	A. In 2	Actual PID value (parameter 3.060)
20	A GND (Ground 10 V)	Ground

Terminal assignment X6 (relay 1)

Terminal no.	Designation	(Terminal) assignment
1	COM	Centre contact relay 1
2	NO	Normally open contact relay 1
3	NC	Normally closed contact relay 1

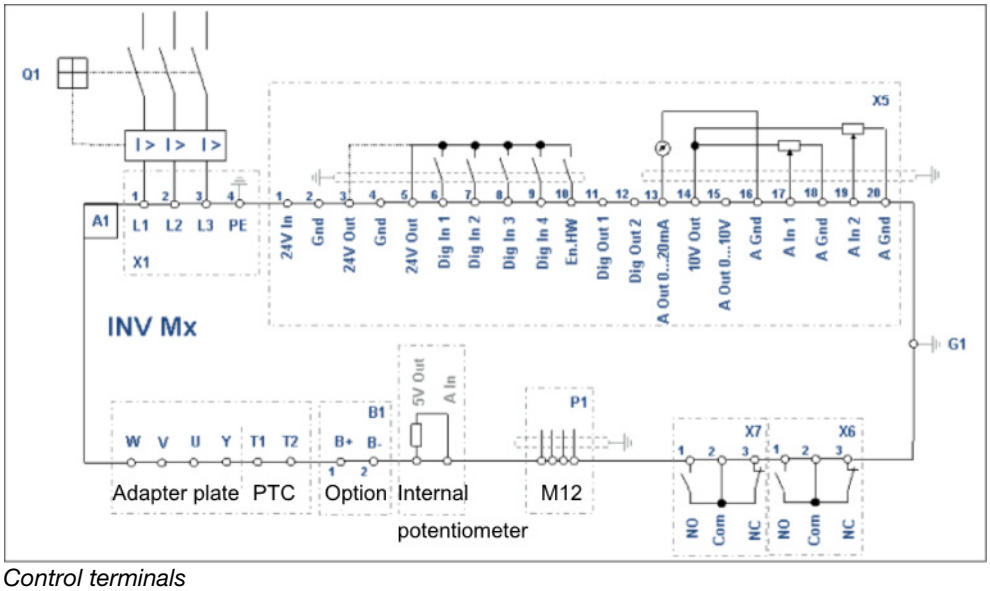
In the factory setting, relay 1 is programmed as "fault relay" (parameter 4.190).

Terminal assignment X7 (relay 2)

Terminal no.	Designation	(Terminal) assignment
1	COM	Centre contact relay 2
2	NO	Normally open contact relay 2
3	NC	Normally closed contact relay 2

In the factory setting, relay 2 is programmed as "fault relay" (parameter 4.210).

5.3.7 Wiring diagram



Control terminals

The drive controller is ready for operation after connection to a 400 V AC power supply (to the terminals L1 to L3) or after connection to a 565 V DC power supply (to the terminals L1 and L3).

Alternately, there is the option to put the drive controller in operation by connecting an external 24 V voltage.

The required presetting is described in the chapter "System parameters".

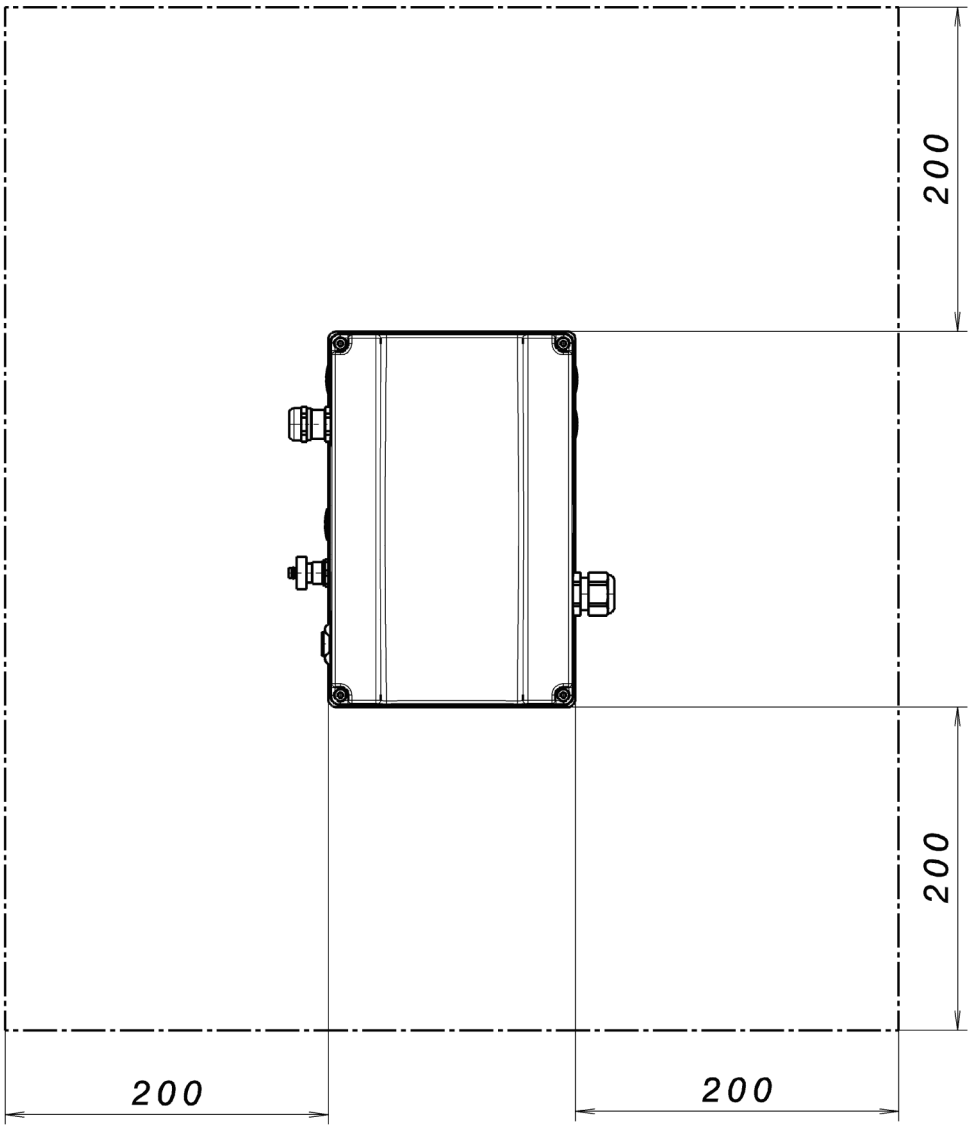
5.4 Installing the wall-mounted drive controller

5.4.1 Installation location that is suitable for wall mounting

! Please make sure that the installation location for wall mounting meets the following conditions:

1. The drive controller must be mounted on a flat, solid surface.
2. The drive controllers may only be mounted on non-combustible surfaces.
3. There must be at least a 20-cm-wide clearance all around the drive controller to ensure free convection.

The following figure gives you the mounting dimensions and the necessary clearance for the installation of the drive controller.



Minimum distances

For wall mounting, a maximum line length of 5 m is permitted between the motor and the drive controller. A shielded cable with the cross section required in each case should be used. A PE connection should be established (below the terminal board the wall adapter)!

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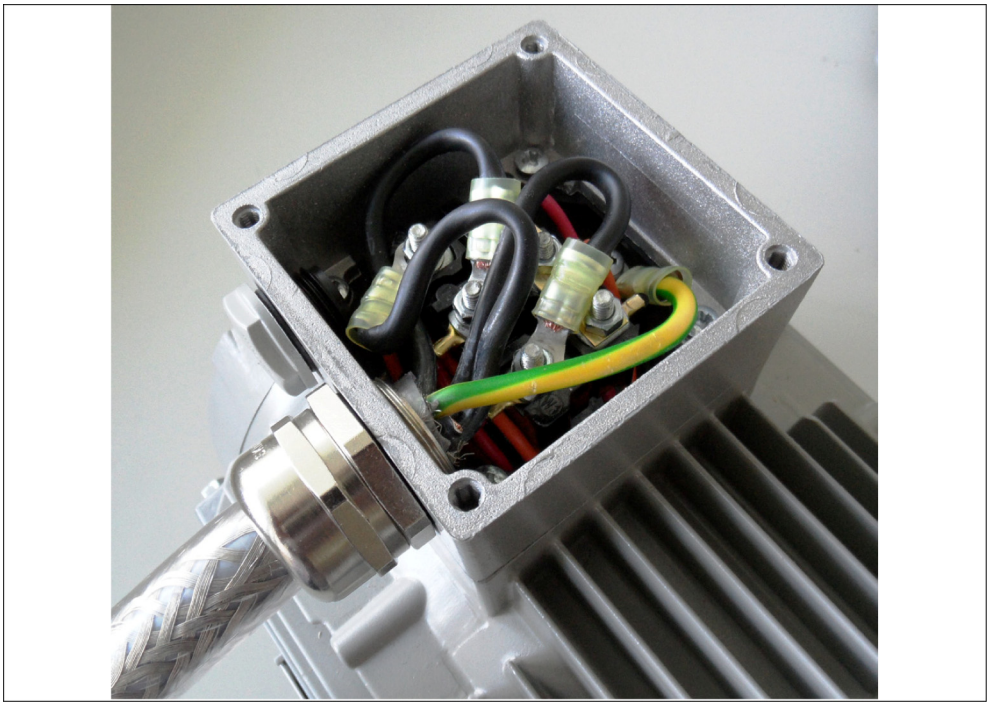
5.4.2 Mechanical installation



Wiring at the motor connection box

1. Open the motor connection box.

NOTICE
Depending on the desired motor voltage, star or delta connection should be made in the motor connection box.

2. When connecting the shielded motor cable to the motor connection box, use suitable EMC fittings and ensure proper (large surface) contact with the shield.
3. Connecting a PE connection to the motor connection box is mandatory.
4. Reconnect the motor connection box.

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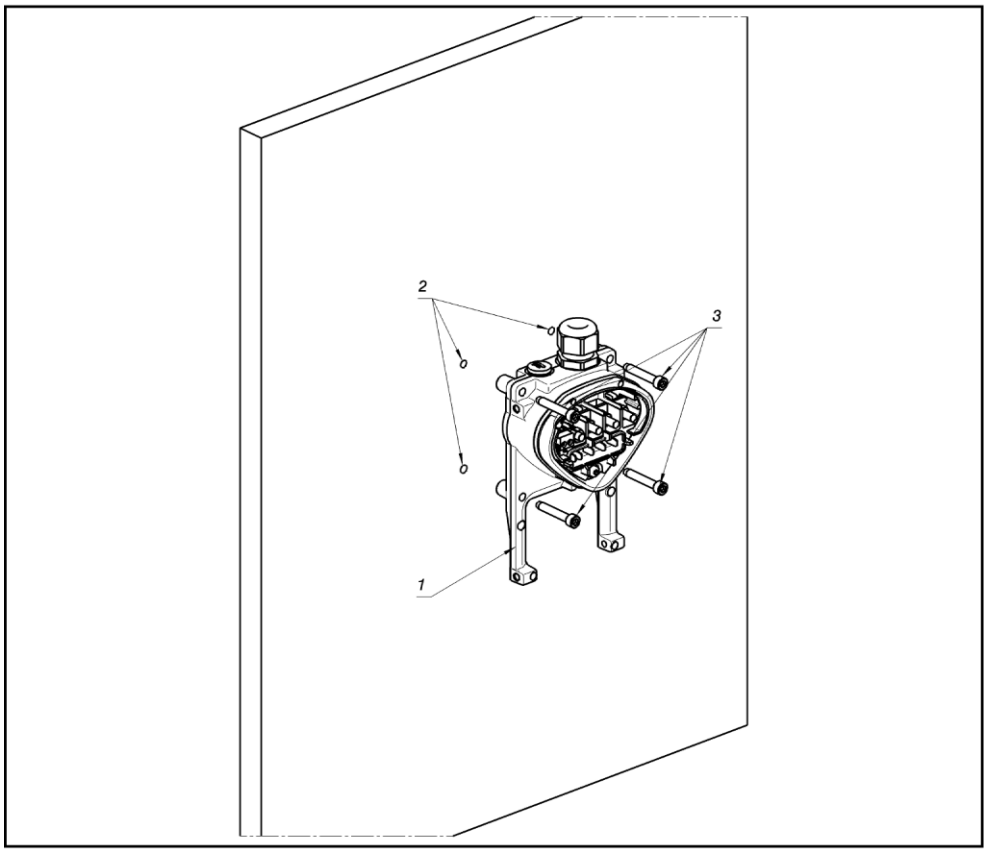

Mounting the adapter plate to a wall

⚠ WARNING

Risk of injury due to incorrect assembly!

① The drive controller may not be installed without an adapter plate.

5. Find a location that corresponds to the required ambient conditions, as described in the "Installation requirements" section.
6. In order to achieve optimum self-convection of the drive controller, it must be ensured during assembly that the (EMC) fitting points upward.
7. Without additional ventilation of the drive controller, only vertical mounting is allowed.

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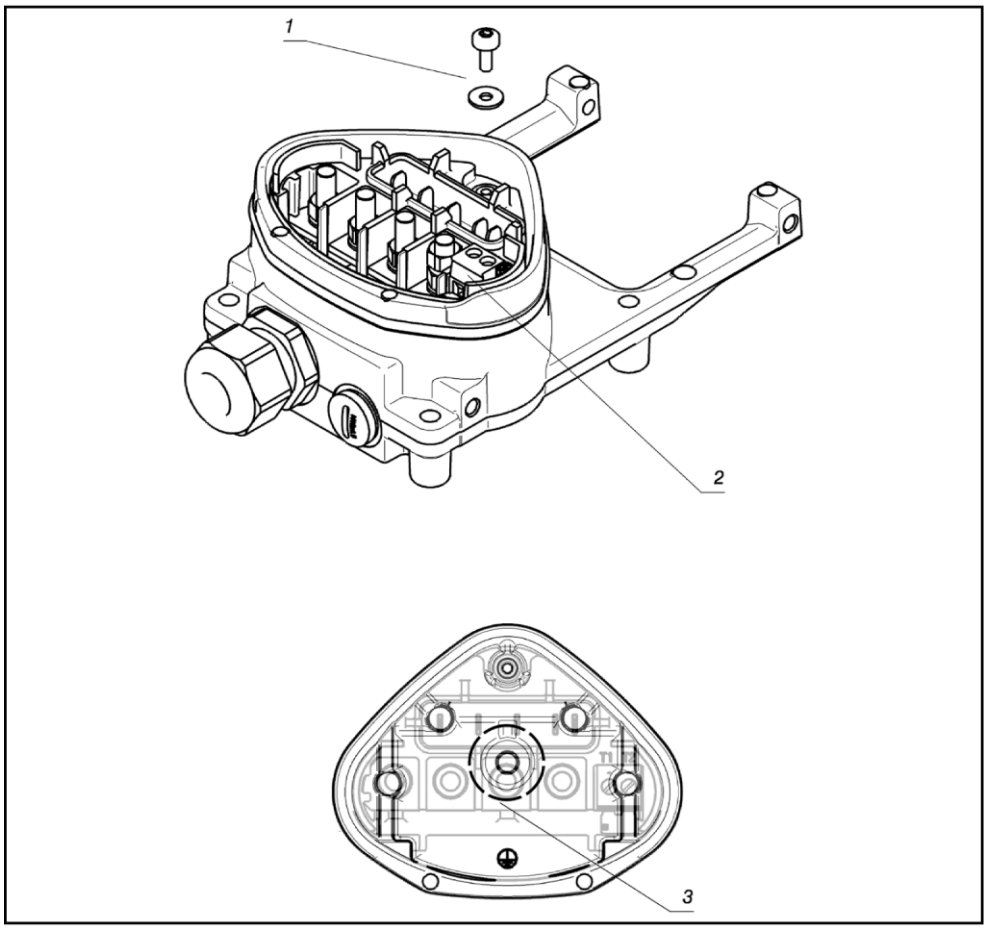

Wiring

8. Loosen the screw (1) to remove the contact plate from the adapter plate. Below this contact plate is the (M6x15) PE connection (3).
9. Lead the connection cable from the motor via the integrated EMC fitting into the adapter plate.
10. This PE connection (torque: **4.0 Nm** [2.95 ft lbs]) must be connected to the same earth potential of the motor. The cross section of the equipotential bonding conductor must correspond to at least the cross-section of the mains cable.
11. Reattach the contact plate using the screw (1).
12. Wire the motor cable to the contacts U, V and W (possibly also the neutral point) in the terminal, as described in "Basic connection variations" section. Use the cable lugs (M5) for this.
13. Before connecting a possibly existing motor PTC to the terminals T1 and T2, please remove the pre-assembled jumper (2).
    The PTC motor is not electrically isolated following connection of the drive controller. Therefore, the connection must be made using a separate motor cable.
    To this end, the dummy plug must be replaced with a suitable standard screw fitting and insert the two ends onto T1 and T2.

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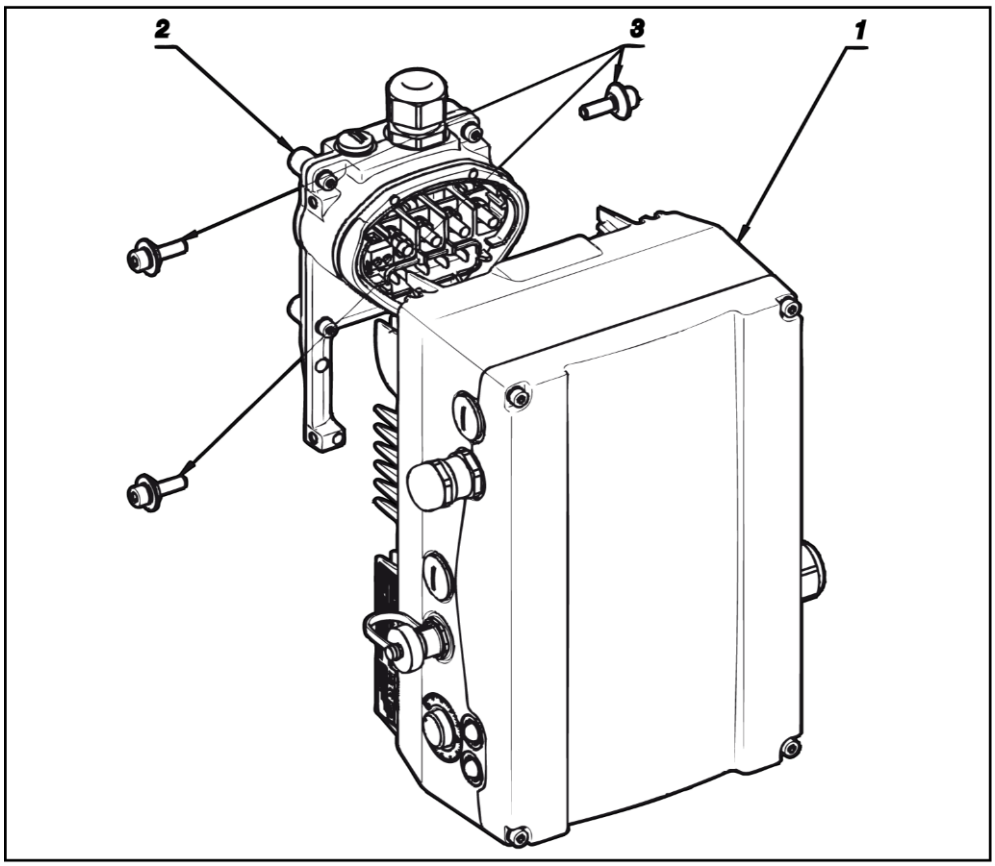

Mount the drive controller

14. Place the drive controller (1) on the adapter plate (2) such that the collar of the adapter dips into the opening at the bottom of the cooling element.
15. Secure the drive controller to the adapter plate using the screws (3) (torque: **4.0 Nm** [2.95 ft lbs]).

5.4.3 Power connection

The power connections are made as described in the sections Power connection of sizes A - C [→ 22] and Power connection of size D [→ 23].

5.4.4 Braking chopper

The braking connections are made as described in the section Connections for braking resistor [→ 24].

5.4.5 Control terminals

The control terminals are provided as described in the section Control terminals [→ 24].

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6.1 Safety information for commissioning

⚠ WARNING

Risk of injury!
The non-observance of warnings can result in severe bodily injury or substantial property damage.

1. Make sure that the power supply provides the correct voltage and is designed for the necessary current.
2. Use suitable circuit breaker with the specified nominal current between the mains supply and drive controller.
3. Use appropriate fuses with the corresponding current values between the mains supply and the drive controller (see Technical data [→ 64]).
4. The drive controller must be correctly earthed to the motor. Not doing so may result in serious injury.

NOTICE

Risk of damage!
The drive controller can be damaged in the case of non-compliance with the instructions and destroyed during subsequent handling.

① Commissioning may only be carried out by qualified personnel. Safety precautions and warnings must always be observed.

6.2 Communication

The drive controller can be put into operation in the following ways:

- using the PC software

PC software - start screen

- via the hand-held unit MMI

MMI hand-held unit

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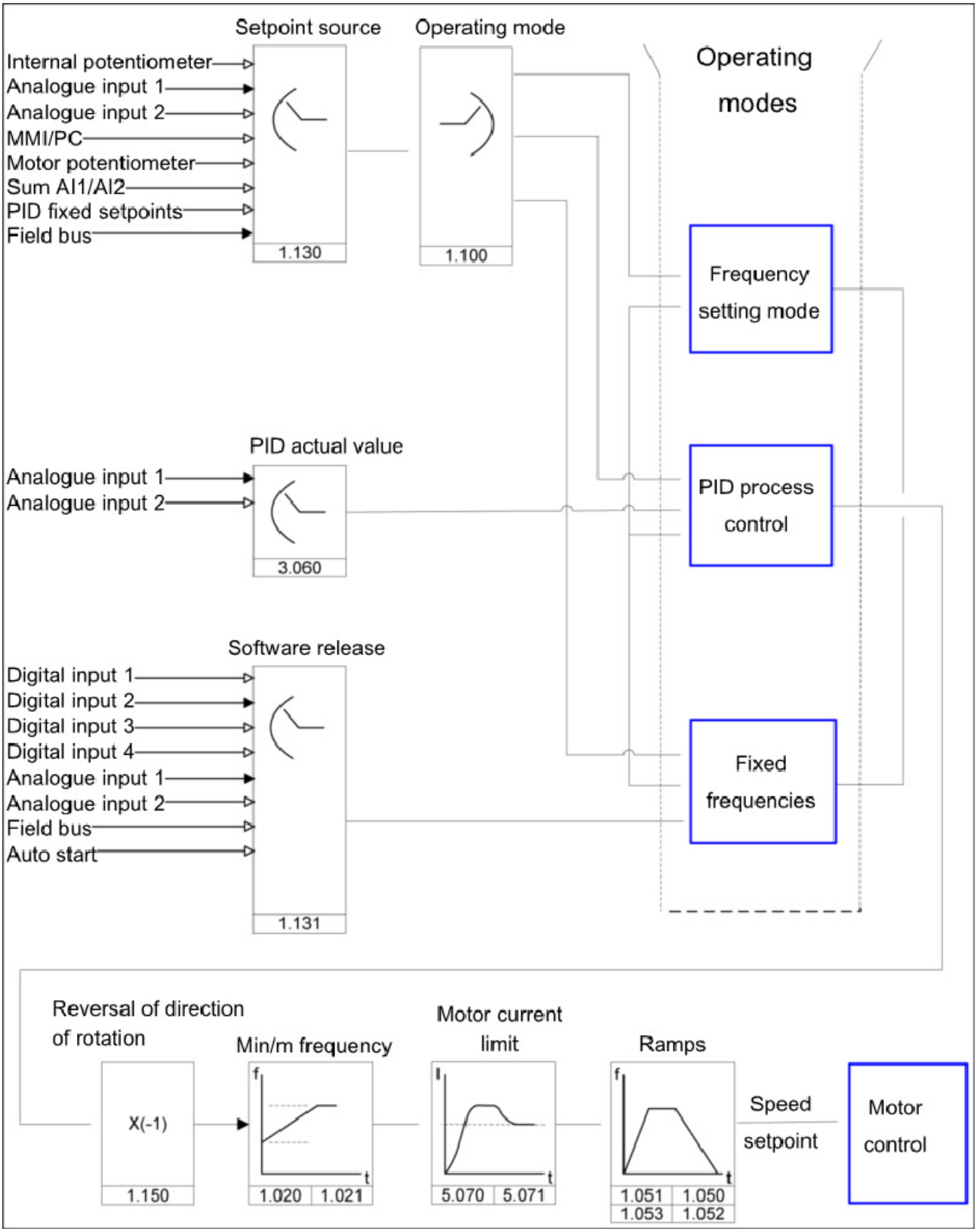
6.3 Block diagram



General structure setpoint generation

6.4 Commissioning steps

The drive control can be parameterised on the motor prior to installation.

① To this end, the drive controller has a 24-V low-voltage input, which powers the electronic parts, and without which a mains voltage must be supplied.

Commissioning can be done with a USB PC communication cable to connector M12 with integrated RS485/RS232 interface converter (2FC4521-0ER00) or via the MMI hand-held unit, including connection cable RJ11 to connector M12 (2FX4520-0ER00).

6.4.1 Start up the integrated drive control

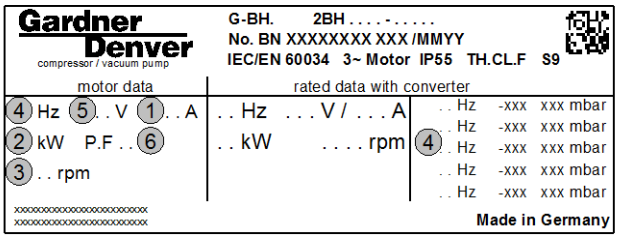
Prior to delivery, the motor data set was installed on the drive control and requires no further settings.

With a high signal on terminal strip X5 through the hardware release (En-HW) on terminal no. 10 and software release on terminal no. 6 (digital input 1), the drive control can be put into operation (e.g. control via analogue input 1 with 0-10 V).

6.4.2 Commission the drive control wall assembly and replacement

Commissioning with PC

1. Install PC software (you can obtain program software free of charge from the manufacturer or at www.gd-elmorietschle.de).
   Required operating system Windows XP or Windows 7 (32/64 bit). It is recommended to carry out the installation as the administrator.
2. Connect the PC via connection cable to the M12 connector M1.
3. Load the motor data set and continue with the application settings.
   OR
   determine the motor data set (parameters 33.030 to 33.050). If necessary, optimise the speed controller (parameter 34.100 to 34.101).


Gardner Denver
compressor / vacuum pump
G-BH. 2BH . . . . - . . . . .
No. BN XXXXXXXX XXX /MMYY
IEC/EN 60034 3~ Motor IP55 TH.CL.F S9
motor data
rated data with converter
4 Hz 5 . . V 1 . . A
2 kW P.F . . 6
3 . . rpm
. . Hz . . . V / . . . A
. . kW . . . . rpm
. . Hz -xxx xxx mbar
. . Hz -xxx xxx mbar
4 . . Hz -xxx xxx mbar
. . Hz -xxx xxx mbar
. . Hz -xxx xxx mbar
xxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxx
Made in Germany

Motor data rating plate (example)

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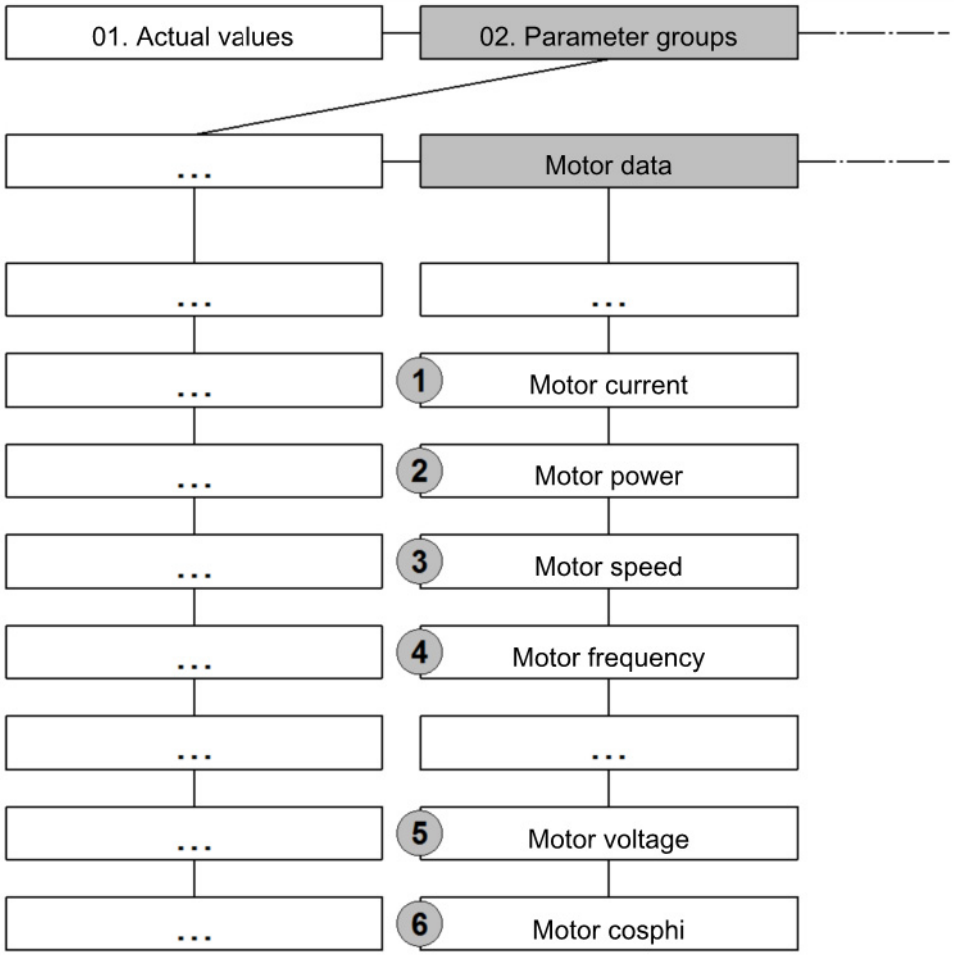

4. Perform motor identification.
5. Implement application settings (ramps, inputs, outputs, setpoints, etc.).
6. Optional: Define access level (1 - HAND-HELD UNIT MMI, 2 - user 3 - manufacturer).
7. Once all settings have been implemented, with a high signal on terminal strip X5 through the hardware release (En-HW) on terminal no. 10 and software release on terminal no. 6 (digital input 1), the drive control can be put into operation (e.g. control via analogue input 1 with 0-10 V).

For an optimum operating structure of the PC software, the parameters are divided into access levels. A distinction is made between:

1. Hand-held unit - the drive controller is programmed using the hand-held unit.
2. User - the drive control can be programmed with the basic parameters using the PC software.
3. User - the drive control can be programmed with an advanced selection of parameters using the PC software.

Commissioning with the MMI hand-held unit

For commissioning with the MMI hand-held unit, see MMI hand-held unit operating manual [➙ 6].

In this chapter, you will find

- an introduction to the parameters
- an overview of the most important commissioning and operating parameters

7.1 Safety instructions for handling the parameters

⚠ WARNING

Risk of injury from restarting motors!
The non-observance of warnings can result in severe bodily injury or substantial property damage.

① Certain parameter settings and the changing of parameter settings during operation can cause the drive controller to restart automatically after a power failure, or cause undesirable changes in the operating characteristics.

If parameters are changed during operation, it may take a few seconds before the effect becomes apparent.

7.2 General information on parameters

7.2.1 Explanation of operating modes

The operating mode is the instance in which the actual setpoint value is generated. This is a simple conversion of the raw input setpoint value into a speed setpoint in the case of the frequency setting mode and control of a specific process variable by comparing the setpoint- and actual values in the case of the PID process control.

Frequency setting mode:

The setpoints from the "setpoint source" (1.130) are rescaled into frequency setpoints. 0% corresponds to the "minimum frequency" (1.020), 100% corresponds to the "maximum frequency" (1.021).

The prefix of the setpoint is the decisive factor in rescaling.

PID process control:

The setpoint for the PID process controller is read as percentage in the "frequency setting mode" operating mode. 100% corresponds to the working range of the connected sensor, which is read from the actual value input (selected by the "PID actual value").

Depending on the control deviation, a speed control variable is issued at the controller output, based on the amplification factors for the P component (3.050), I component (3.051) and D component (3.052). In order to prevent the increase of the integral component to infinity in the case of uncontrollable control deviations, it is also limited to the control value limit when reaching the same (corresponds to "maximum frequency" (1.021).

PID inverse:

Inversion of the PID feedback can be done with the help of parameter 3.061. The actual value is read invertedly, i.e. 0V…10V correspond internally to 100% ... 0%.

Please bear in mind that the setpoint should also be specified inversely!

An example:

A sensor with an analogue output signal (0V…10V) is to be operated as the actual value source (at AIx). At an output quantity of 7V (70%), it should be regulated inversely. The internal actual value then corresponds to 100% - 70% = 30%. That is, the setpoint to be specified is 30%.

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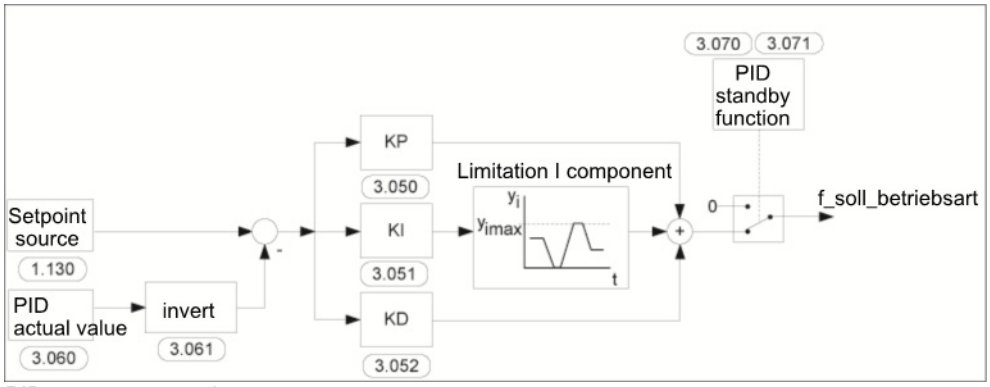
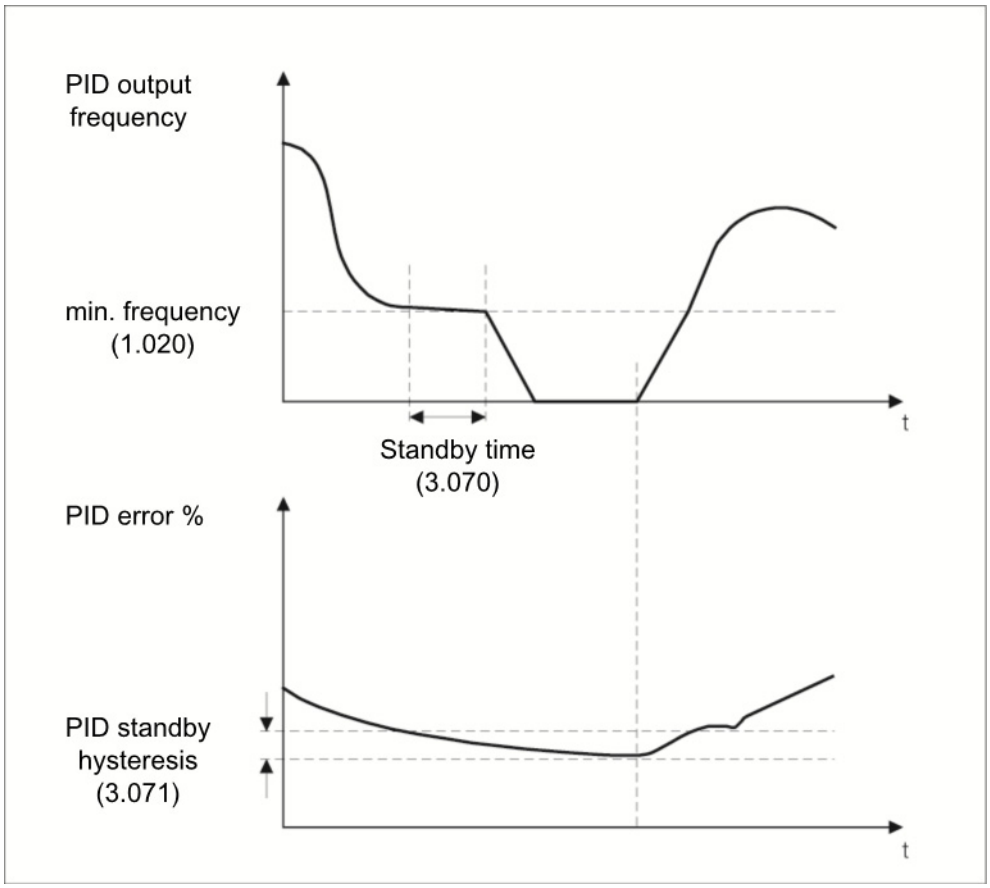


PID process control

Standby function for PID process control:

This function can be used in applications such as pressure boosting systems, in which it is controlled to a specific process variable using the PID process control and the pump should run at a "minimum frequency" (1.020) to lead to energy savings. Since the inverter reduces the pump speed with decreasing process variable during normal operation, but can never go below the "minimum frequency" (1.020), it is possible to stop the motor when it runs at the "minimum frequency" (1.020) for a wait time, the "PID standby time" (3.070).

After the actual value deviates from the setpoint by the set % value, the "PID standby hysteresis" (3.071), the (motor) control is restarted.



Standby function for PID process control

Fixed frequency

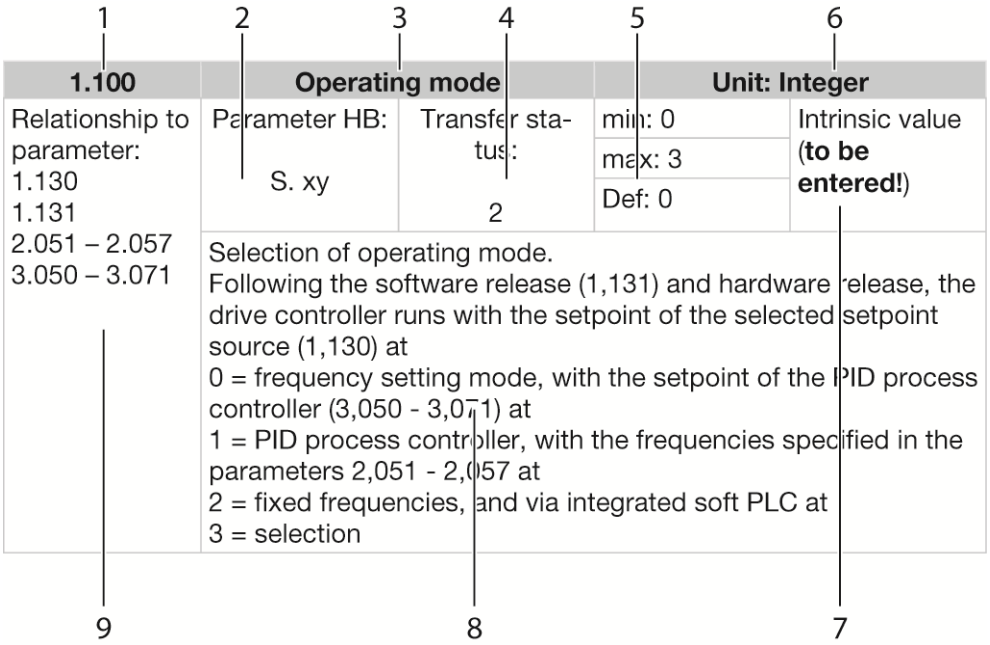
In this operating mode, fixed frequency setpoints are passed on to the motor control. There are 7 fixed frequencies (2.051 - 2.057) which are linked in BCD format to the digital inputs 1 to 3. These seven fixed frequencies can be enabled via the parameter "Auswahl_Festfrequenz" (2.050) into three groups:

0 = fixed frequency 1, 1 = fixed frequency 1 to 3, 2 = fixed frequency 1 to 7.

Logic table of fixed frequencies

DI 3	DI 2	DI 1	Selection	Parameters	Presetting
0	0	1	Fixed frequency 1	2.051	34 Hz
0	1	0	Fixed frequency 2	2.052	67 Hz
0	1	1	Fixed frequency 3	2.053	50 Hz
1	0	0	Fixed frequency 4	2.054	0 Hz
1	0	1	Fixed frequency 5	2.055	0 Hz
1	1	0	Fixed frequency 6	2.056	0 Hz
1	1	1	Fixed frequency 7	2.057	0 Hz

7.2.2 Structure of parameter tables



Example of parameter table

1 Parameter number

2 Description in the parameters manual on page...

3 Parameter name

4 Transfer status
0 = turn on and off to take over the drive controller
1 = at speed 0
2 = in operation

5 Range of values (from - to - factory setting)

6 Unit

7 Box for entering the inherent value

8 Explanation of the parameters

9 Other parameters related to this parameter

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7.3 Application parameter

7.3.1 Basic parameters

1.020	Minimum frequency		Unit: Hz	
Relationship to parameter: 1.150 3.070	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 400 Def: 25	Intrinsic value (**to be entered!**)
	The minimum frequency is the frequency that is supplied by the drive controller as soon as it is released and no additional setpoint is pending. This frequency is not reached if a) it is accelerated from the stationary drive. b) the FI is locked. The frequency is then reduced to 0 Hz before it is locked. c) the FI reverses (1.150). Reversing the field of rotation occurs at 0 Hz. d) the standby function (3.070) is active.			

1.021	Maximum frequency		Unit: Hz	
Relationship to parameter: 1.050 1.051	Parameter HB: S. xy	Transfer status: 2	min: 5 max: 400 Def: see data plate	Intrinsic value (**to be entered!**)
	The maximum frequency is the highest frequency issued by the converter as a function of the setpoint.			

1.050	Braking time		Unit: s	
Relationship to parameter: 1.021 1.054	Parameter HB: S. xy	Transfer status: 2	min: 0.1 max: 1000 Def: Type-specific	Intrinsic value (**to be entered!**)
	The braking time 1 is the time it takes for the inverter to decelerate from the max. frequency (1.021) to 0 Hz. If the set braking time cannot be met, the fastest possible braking time is implemented.			

1.051	Power-up time 1		Unit: s	
Relationship to parameter: 1.021 1.054	Parameter HB: S. xy	Transfer status: 2	min: 0.1 max: 1000 Def: Type-specific	Intrinsic value (**to be entered!**)
	The power-up time 1 is the time it takes the inverter to accelerate from 0 Hz to the max. frequency. The power-up time can be extended under certain circumstances, e.g. overload of the drive controller.			

1.052	Braking time 2		Unit: s	
Relationship to parameter: 1.021 1.054	Parameter HB: S. xy	Transfer status: 2	min: 0.1 max: 1000 Def: 10	Intrinsic value (**to be entered!**)
	The braking time 2 is the time it takes for the inverter to decelerate from the max. frequency (1.021) to 0 Hz. If the set braking time cannot be met, the fastest possible braking time is implemented.			

1.053	Power-up time 2		Unit: s	
Relationship to parameter: 1.021 1.054	Parameter HB: S. xy	Transfer status: 2	min: 0.1 max: 1000 Def: 10	Intrinsic value (**to be entered!**)
	The power-up time 2 is the time it takes the inverter to accelerate from 0 Hz to the max. frequency. The power-up time can be extended under certain circumstances, e.g. overload of the drive controller.			

1.054	Ramp selection		Unit: integer	
Relationship to parameter: 1.050 – 1.053	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 6 Def: 0	Intrinsic value (**to be entered!**)
	Selection of the used pair of ramps. 0 = braking time 1 (1.050) / power-up time 1 (1.051) 1 = braking time 2 (1.052) / power-up time 2 (1.053) 2 = digital input 1 (false = pair of ramps 1 / true = pair of ramps 2) 3 = digital input 2 (false = pair of ramps 1 / true = pair of ramps 2) 4 = digital input 3 (false = pair of ramps 1 / true = pair of ramps 2) 5 = digital input 4 (false = pair of ramps 1 / true = pair of ramps 2) 6 = customer PLC 7 = analogue input 1 8 = analogue input 2 9 = virtual output 1			

1.100	Operating mode		Unit: integer	
Relationship to parameter: 1.130 1.131 2.051 – 2.057 3.050 – 3.071	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 3 Def: 0	Intrinsic value (**to be entered!**)
	Selection of operating mode. Following the software release (1.131) and hardware release, the drive controller runs at 0 = frequency setting mode with the setpoint of the selected setpoint source (1.130) 1 = PID process controller, with the setpoint of the PID process controller (3.050 - 3.071) 2 = fixed frequencies, with the frequencies specified in the parameters 2.051 - 2.057 3 = selection via integrated soft PLC			

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1.130	Setpoint source		Unit: integer	
Relationship to parameter: 3.062 – 3.069	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 10 Def: 1	Intrinsic value (**to be entered!**)
	Specifies the source from which the setpoint should be read. 0 = internal potentiometer 1 = analogue input 1 2 = analogue input 2 3 = MANUAL CONTROL UNIT MMI/PC 4 = SAS 6 = motor potentiometer 7 = total analogue inputs 1 and 2 8 = PID fixed setpoints (3.062 to 3.069) 9 = field bus 10 = integrated soft PLC			

1.131	Software release		Unit: integer	
Relationship to parameter: 1.132 1.150 2.050 4.030 4.060	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 13 Def: 0	Intrinsic value (**to be entered!**)
	⚠ **WARNING! Depending on the change made, the motor may start to run directly.** Selection of the source for the control release. 0 = digital input 1 1= digital input 2 2 = digital input 3 3 = digital input 4 4= analogue input 1 (must be selected in parameter 4.030) 5 = analogue input 2 (must be selected in parameter 4.060) 6 = field bus 7 = SAS 8 = digital input 1 right/digital input 2 left 1.150 must be set to "0" 9 = auto start 10= integrated soft PLC 11 = fixed frequency inputs (all inputs that have been selected in parameter 2.050) 12 = internal potentiometer 13 = membrane keyboard (start & stop keys) 14 = MMI/PC 15 = virtual output 1 If the hardware release and a setpoint are applied, the motor may start to run directly! This cannot be prevented even with parameter 1.132.			

1.132	Start-up protection		Unit: integer	
Relationship to parameter: 1.131	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 6 Def: 0	Intrinsic value (**to be entered!**)
	Selection of characteristics on the control release (parameter 1.131). No effect if auto start was selected. 0 = immediate start at high signal at the start input of the control release 1 = start only with increasing slope at the start input of the control release 2 = digital input 1 (function active at high signal) 3 = digital input 2 (function active at high signal) 4 = digital input 3 (function active at high signal) 5 = digital input 4 (function active at high signal) 6 = integrated soft PLC 7 = analogue input 1 8 = analogue input 2			

1.150	Direction of rotation		Unit: integer	
Relationship to parameter: 1.131 4.030 4.060	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 12 Def: 1	Intrinsic value (**to be entered!**)
	Selection of the specified direction of rotation. 0 = setpoint-dependent (depending on the prefix of the setpoint: positive: forward; negative: reverse) 1 = forward only (change in the direction of rotation not possible) 2 = reverse only (change in the direction of rotation not possible) 3 = digital input 1 (0V = forward, 24V = reverse) 4 = digital input 2 (0V = forward, 24V = reverse) 5 = digital input 3 (0V = forward, 24V = reverse) 6 = digital input 4 (0V = forward, 24V = reverse) 7 = integrated soft PLC 8 = analogue input 1 (must be selected in parameter 4.030) 9 = analogue input 2 (must be selected in parameter 4.060) 10 = membrane keyboard with key for reversal of the direction of rotation (only with running motor) 11 = membrane keyboard with key 1 for forward/2 for reverse (reverse is always possible) 12 = membrane keyboard with key 1 for forward/2 for reverse (reverse only possible when the motor is not running) 13 = virtual output 1			

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1.180	Acknowledgement function		Unit: integer	
Relationship to parameter: 1.181 1.182	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 5 Def: 3	Intrinsic value (**to be entered!**)
	Selects the source for the error acknowledgement. Errors can only be acknowledged if the error is no longer present. Certain errors can only be acknowledged by switching the controller on and off, see list of errors. Automatic acknowledgement via parameter 1.181. 0 = no manual acknowledgement possible 1 = increasing slope at the digital input 1 2 = increasing slope at the digital input 2 3 = increasing slope at the digital input 3 4 = increasing slope at the digital input 4 5 = membrane keyboard (reset key)			

1.181	Automatic acknowledgement function		Unit: s	
Relationship to parameter: 1.180 1.182	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 1000000 Def: 0	Intrinsic value (**to be entered!**)
	Besides the acknowledgement function (1.180), automatic fault acknowledgement can also be selected. 0 = no automatic acknowledgement > 0 = time for the automatic reset of the error in seconds			

1.182	Automatic acknowledgement count		Unit:	
Relationship to parameter: 1.180 1.181	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 500 Def: 5	Intrinsic value (**to be entered!**)
	In addition to the automatic acknowledgement function (1.181), the maximum number of automatic acknowledgements can be limited here. 0 = no limit of the automatic acknowledgements > 0 = number of maximum automatic acknowledgements allowed			

7.3.2 Fixed frequency

This mode must be selected in parameter 1.100, see also selection of the operating mode.

2.050	Fixed frequency mode		Unit: integer	
Relationship to parameter: 1.100 2.051 – 2.057	Parameter HB:	Transfer status:	min: 0 max: 3 Def: 1	Intrinsic value (**to be entered!**)
	Selection of the digital inputs used for the fixed frequencies. 0 = digital In 1 (fixed frequency 1)(2.051) 1 = digital In 1, 2 (fixed frequencies 1 - 3) (2.051 - 2.053) 2 = digital In 1, 2, 3 (fixed frequencies 1 - 7) (2.051 - 2.057) 3 = membrane keyboard (key 1 = fixed frequency 1/key 2 = fixed frequency 2)			

2.051 – 2.057	Fixed frequency		Unit: Hz	
Relationship to parameter: 1.020 1.021 1.100 1.150 2.050	Parameter HB:	Transfer status:	min: -400 max: +400 Def: 2.051: 34 2.052: 67 2.053: 50	Intrinsic value (**to be entered!**)
	The frequencies that should be output depending on the switching pattern on the digital inputs 1 - 3 set in parameter 2.050. See fixed frequency, Explanation of operating modes [→ 36].			

7.3.3 Motor potentiometer

This mode must be selected in parameter 1.130. This function can be used both as a setpoint source for the frequency setting mode, as well as for the PID process controller.

2.150	MOP digital input		Unit: integer	
Relationship to parameter: 1.130 4.030 4.060	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 8 Def: 0	Intrinsic value (**to be entered!**)
	Selection of the source to increase and decrease the setpoint. 0 = digital input 1 + / digital input 2 - 1 = digital input 1 + / digital input 3 - 2= digital input 1 + / digital input 4 - 3 = digital input 2 + / digital input 3 - 4 = digital input 2 + / digital input 4 - 5 = digital input 3 + / digital input 4 - 6 = analogue Input 1 + / analogue Input 2 - (must be selected in parameter 4.030/4.060) 7 = DRIVE CONTROLLER soft PLC 8 = membrane keyboard (key 1 - / key 2 +)			

2.151	MOP increment		Unit: %	
Relationship to parameter: 1.020 1.021	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 100 Def: 1	Intrinsic value (**to be entered!**)
	Increment at which the setpoint value is to be changed per keystroke.			

2.152	MOP increment time		Unit: s	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 2	min: 0.02 max: 1000 Def: 0.04	Intrinsic value (**to be entered!**)
	Specifies the time in which the setpoint is summed up with permanently present signal.			

2.153	MOP response time		Unit: s	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 2	min: 0.02 max: 1000 Def: 0.3	Intrinsic value (**to be entered!**)
	Specifies the time until the present signal is considered to be permanent.			

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2.154	MOP retentive		Unit: integer	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 1 Def: 0	Intrinsic value (**to be entered!**)
	Determines whether the setpoint of the motor potentiometer is retained even after power failure. 0 = deactivated 1 = activated			

7.3.4 PID process controller

This mode must be selected in parameter 1.100, the setpoint source must be selected in parameter 1.130, see also fixed frequency, Explanation of operating modes [→ 36].

3.050	PID P gain		Unit:	
Relationship to parameter: 1.100 1.130	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 100 Def: 0.25	Intrinsic value (**to be entered!**)
	Gain factor proportional component of the PID controller.			

3.051	PID P gain		Unit: s^{-1}	
Relationship to parameter: 1.100 1.130	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 100 Def: 0.25	Intrinsic value (**to be entered!**)
	Gain factor integral component of the PID controller.			

3.052	PID P gain		Unit: s	
Relationship to parameter: 1.100 1.130	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 100 Def: 0	Intrinsic value (**to be entered!**)
	Gain factor differential component of the PID controller.			

3.060	PID actual value		Unit: integer	
Relationship to parameter: 1.100 1.130 3.061	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 2 Def: 1	Intrinsic value (**to be entered!**)
	Selection of the input source, from which the actual value for the PID process controller is read. 0 = analogue input 1 1 = analogue input 2 2 = integrated soft PLC			

3.061	PID inverse		Unit: integer	
Relationship to parameter: 3.060	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 1 Def: 0	Intrinsic value (**to be entered!**)
	The actual value source (parameter 3.060) is inverted. 0 = deactivated 1 = activated			

3.062 – 3.068	PID fixed setpoints		Unit: %	
Relationship to parameter: 1.100 1.130	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 100 Def: 0	Intrinsic value (**to be entered!**)
	PID fixed setpoint values that should be output at the digital inputs 1 – 3 set in parameter 3.069, depending on the switching pattern (must be selected in parameter 1.130).			

3.069	PID fixed setpoint mode		Unit: integer	
Relationship to parameter: 1.100 3.062 – 3.068	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 2 Def: 0	Intrinsic value (**to be entered!**)
	Selection of the digital inputs used for the fixed frequencies. 0 = digital In 1 (PID fixed setpoint 1) (3.062) 1 = digital In 1, 2 (PID fixed setpoint 1-3) (3.062 to 3.064) 2 = digital In 1, 2, 3 (PID fixed setpoint 1-7) (3.062 - 3.068)			

3.070	PID standby time		Unit: s	
Relationship to parameter: 1.020	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 10000 Def: 0	Intrinsic value (**to be entered!**)
	If the drive controller runs the set time at its minimum frequency (parameter 1.020), the motor is stopped (0 Hz), see also PID process control, Explanation of operating modes [→ 36]. 0 = deactivated >0 = wait time until the activation of the standby function			

3.071	PID standby hysteresis		Unit: %	
Relationship to parameter: 3.060	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 50 Def: 0	Intrinsic value (**to be entered!**)
	Wake-up condition of the PID controller from the standby function. If the control deviation is greater than the set value in %, the control restarts, see also operating modes of PID controller.			

7.3.5 Analogue inputs

For analogue inputs 1 and 2 (AIx - illustration AI1/AI2)

4.020/4.050	AIx input type		Unit: integer	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 2	min: 1 max: 2 Def: 4.020 1 4.050 2	Intrinsic value (**to be entered!**)
	Function of the analogue inputs 1/2. 1 = voltage input 2 = current input			

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4.021/4.051	AIx-Norm. Low		Unit: %	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 100 Def: 0	Intrinsic value (**to be entered!**)
	Specifies the minimum value of the analogue inputs as a percentage of the final range value. Example: 0... 10V or 0... 20 mA = 0 %... 100% 2... 10V or 4... 20mA = 20%... 100%			

4.022/4.052	AIx-Norm. High		Unit: %	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 100 Def: 100	Intrinsic value (**to be entered!**)
	Specifies the maximum value of the analogue inputs as a percentage of the final range value. Example 0…10V or 0…20mA = 0%…100% 2…10V or 4…20mA = 20%…100%			

4.023/4.053	AIx backlash		Unit: %	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 100 Def: 0	Intrinsic value (**to be entered!**)
	Backlash as percentage of final range value of the analogue inputs.			

4.024/4.054	AIx filtering time		Unit: s	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 2	min: 0.02 max: 1.00 Def: 0	Intrinsic value (**to be entered!**)
	Filtering time of the analogue inputs in seconds.			

4.030/4.060	AIx function		Unit: integer	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 1 Def: 0	Intrinsic value (**to be entered!**)
	Function of the analogue inputs ½. 0 = analogue input 1 = digital input			

4.033/4.063	AIx - physical unit		Unit:	
Relationship to parameter: 4.034/4.064 4.035/4.065	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 10 Def: 0	Intrinsic value (**to be entered!**)
	Selection of the different physical variables to be displayed. 0 = % 1 = bar 2 = mbar 3 = psi 4 = Pa 5 = m^3/h 6 = l/min 7 = °C 8 = °F 9 = m 10 = mm			

4.034/4.064	AIx physical minimum		Unit:	
Relationship to parameter: 4.033/4.063 4.035/4.065	Parameter HB: S. xy	Transfer status: 2	min: -10000 max: +10000 Def: 0	Intrinsic value (**to be entered!**)
	Selection of the lower limit of a physical quantity to be displayed.			

4.035/4.065	AIx - physical maximum		Unit:	
Relationship to parameter: 4.033/4.063 4.035/4.065	Parameter HB: S. xy	Transfer status: 2	min: -10000 max: +10000 Def: 100	Intrinsic value (**to be entered!**)
	Selection of the upper limit of a physical quantity to be displayed.			

7.3.6 Digital inputs

4.110 – 4.113	DIx inverse		Unit: integer	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 1 Def: 0	Intrinsic value (**to be entered!**)
	Using this parameter, the digital input can be inverted. 0 = inactive 1 = active			

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7.3.7 Analogue output

4.100	AO1 function		Unit: integer	
Relationship to parameter: 4.101 4.102	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 40 Def: 5	Intrinsic value (**to be entered!**)
	Selection of the process value that is output at the analogue output. Depending on the process value selected, the standard (4.101/4.102) must be adapted. 0 = not assigned / DRIVE CONTROLLER soft PLC 1 = intermediate circuit voltage 2 = mains voltage 3 = motor voltage 4 = motor current 5 = actual frequency 6 = speed measured externally by speed sensor (if available) 7 = current angle or position (if available) 8 = IGBT temperature 9 = inner temperature 10 = analogue input 1 11 = analogue input 2 12 = rated frequency 13 = motor power 14 = torque 15 = field bus 16 = PID setpoint (above V3.60) 17 = PID actual value (above V3.60)			

4.101	AO1 standard Low		Unit:	
Relationship to parameter: 4.100	Parameter HB: S. xy	Transfer status: 2	min: -10000 max: +10000 Def: 0	Intrinsic value (**to be entered!**)
	Describes the range to be resolved to the output voltage 0 - 10 V or output current 0 - 20mA.			

4.102	AO1 standard High		Unit:	
Relationship to parameter: 4.100	Parameter HB: S. xy	Transfer status: 2	min: -10000 max: +10000 Def: Type-specific	Intrinsic value (**to be entered!**)
	Describes the range to be resolved to the output voltage 0 - 10 V or output current 0 - 20mA.			

7.3.8 Digital outputs

For the digital outputs 1 and 2 (DOx - illustration DO1/DO2)

4.150/4.170	DOx function		Unit: integer	
Relationship to parameter: 4.151/4.171 4.152/4.172	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 50 Def: 4.150: 18 4.170: 19	Intrinsic value (**to be entered!**)
	Selection of the process variable to which the output should switch. 0= not assigned/integrated soft PLC 1= intermediate circuit voltage 2= mains voltage 3= motor voltage 4= motor current 5= actual frequency value 6= – 7= – 8= IGBT temperature 9= inner temperature 10= error (NO) 11= error inverted (NC) 12= output stage release 13= digital input1 14= digital input 2 15= digital input 3 16= digital input4 17= ready for operation (power supply on, hw release is missing, motor at standstill) 18= ready (power supply on, hw release set, motor at standstill) 19= operation (power supply on, hw release set, motor rotates) 20= ready for operation + ready 21= ready for operation + ready + operation 22= ready + operation 23 = motor power 24 = torque 25 = field bus 26 = analogue input 1 (above V3.60) 27 = analogue input 2 (above V3.60) 28 = PID setpoint (above V3.60) 29 = PID actual value (above V3.60) 50 = motor current limit active			

4.151/4.171	DOx On		Unit:	
Relationship to parameter: 4.150/4.170	Parameter HB: S. xy	Transfer status: 2	min: -10000 max: 10000 Def: 0	Intrinsic value (**to be entered!**)
	If the set process variable exceeds the switch-on limit, the output is set to 1.			

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4.152/4.172	DOx Off		Unit:	
Relationship to parameter: 4.150/4.170	Parameter HB: S. xy	Transfer status: 2	min: -10000 max: 10000 Def: 0	Intrinsic value (**to be entered!**)
	If the set process variable falls below the switch-on limit, the output is set to 0.			

7.3.9 Relay

For the relays 1 and 2 (rel.x - illustration rel. 1/rel. 2)

4.190/4.210	Rel.x function		Unit: integer	
Relationship to parameter: 4.191/4.211 4.192/4.212	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 50 Def: 4.190: 11 4.210: 0	Intrinsic value (**to be entered!**)
	Selection of the process variable to which the output should switch. 0= not assigned/integrated soft PLC 1= intermediate circuit voltage 2= mains voltage 3= motor voltage 4= motor current 5= actual frequency value 6= – 7= – 8= IGBT temperature 9= inner temperature 10= error (NO) 11= error inverted (NC) 12= output stage release 13= digital input1 14= digital input 2 15= digital input 3 16= digital input4 17= ready for operation (power supply on, hw release is missing, motor at standstill) 18= ready (power supply on, hw release set, motor at standstill) 19= operation (power supply on, hw release set, motor rotates) 20= ready for operation + ready 21= ready for operation + ready + operation 22= ready + operation 23 = motor power 24 = torque 25 = field bus 26 = analogue input 1 (above V3.60) 27 = analogue input 2 (above V3.60) 28 = PID setpoint (above V3.60) 29 = PID actual value (above V3.60) 50 = motor current limit active			

4.191/4.211	Rel.x on		Unit:	
Relationship to parameter: 4.190/4.210	Parameter HB: S. xy	Transfer status: 2	min: -10000 max: 10000 Def: 0	Intrinsic value (**to be entered!**)
	If the set process variable exceeds the switch-on limit, the output is set to 1.			

4.192/4.212	Rel.x off		Unit:	
Relationship to parameter: 4.190/4.210	Parameter HB: S. xy	Transfer status: 2	min: -10000 max: 10000 Def: 0	Intrinsic value (**to be entered!**)
	If the set process variable falls below the switch-on limit, the output is set to 0.			

4.193/4.213	Rel. x on delay		Unit: s	
Relationship to parameter: 4.194/4.214	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 10000 Def: 0	Intrinsic value (**to be entered!**)
	Specifies the duration of the closing delay.			

4.194/4.214	Rel. x off delay		Unit: s	
Relationship to parameter: 4.193/4.213	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 10000 Def: 0	Intrinsic value (**to be entered!**)
	Specifies the duration of the turn-off delay.			

7.3.10 External error

5.010/5.011	External error 1/2		Unit: integer	
Relationship to parameter: 4.110 to 4.113	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 4 Def: 5.010: 4 5.011: 0	Intrinsic value (**to be entered!**)
	Selection of source via which an external error can be reported. 0 = not assigned / integrated soft PLC 1 = digital input 1 2 = digital input 2 3 = digital input 3 4 = digital input 4 5 = virtual output 1 When a high signal exists at the selected digital input, the inverter switches with error no. 23/24 external error 1/2. By using the parameter 4.110 to 4.113 DIx inverse, the logic of the digital input can be inverted.			

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7.3.11 Motor current limit

This function limits the motor current to a programmed maximum value, after reaching a parametrised current-time area.

This motor current limit is monitored at the application level and thus limited with relatively small dynamics. This has to be considered in the selection of this function.

The maximum value is determined by the parameter "motor current limit in %" (5.070). This is expressed in percentage and is based on the rated motor current from the type plate data "motor current" (33.031).

The maximum current-time area is calculated as the product of the parameter "motor current limit in s" (5.071) and the constant over current of 50% of the desired motor current limit.

As soon as this current-time area is exceeded, the motor current is limited by reducing the rotation speed to the limit value. Thus, if the output current of the drive controller exceeds the motor current (parameter 33.031) multiplied by the set limit in % (parameter 5.070) for the set time (parameter 5.071), the motor speed is reduced until the output current drops below the set limit.

The scaling down is done by a PI controller that works depending on the current difference.

The entire feature can be deactivated by setting the parameter "motor current limit in %" to zero (5.070).

5.070	Motor current limit		Unit: %	
Relationship to parameter: 5.071 33.031	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 250 Def: 0	Intrinsic value (**to be entered!**)
	0 = deactivated			

5.071	Motor current limit		Unit: s	
Relationship to parameter: 5.070 33.031	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 100 Def: 1	Intrinsic value (**to be entered!**)

5.075	Transmission factor		Unit:	
Relationship to parameter: 33.034	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 10000 Def: 1	Intrinsic value (**to be entered!**)
	Here, a transmission factor can be set. With the help of the transmission factor, the display of the mechanical speed can be adapted.			

7.3.12 Blocking detection

5.080	Blocking detection		Unit: integer	
Relationship to parameter: 5.081	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 1 Def: 0	Intrinsic value (**to be entered!**)
	Using this parameter, the blocking detection can be activated. 0 = inactive 1 = active			

5.081	Blocking time		Unit: s	
Relationship to parameter: 5.080	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 50 Def: 2	Intrinsic value (**to be entered!**)
	Specifies the time after which a blocking is detected.			

5.090	Change in the parameter set		Unit: integer	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 7 Def: 0	Intrinsic value (**to be entered!**)
	Selection of the active record. 0 = not assigned 1 = record 1, active 2 = record 2, active 3 = digital input 1 4 = digital input 2 5 = digital input 3 6 = digital input 4 7 = integrated soft PLC 8 = virtual output 1 The 2nd record is only displayed on the PC software if this parameter is <> 0. The valuesof the currently selected record are shown on the display of the hand-held unit.			

7.4 Power parameters

7.4.1 Motor data

33.001	Motor type		Unit: integer	
Relationship to parameter: 33.010	Parameter HB: S. xy	Transfer status: 1	min: 1 max: 2 Def: 1	Intrinsic value (**to be entered!**)
	Selection of the motor type 1 = asynchronous motor 2 = synchronous motor Depending on the motor type selected, the corresponding parameters are displayed. The control mode (parameter 34.010) must also be chosen accordingly.			

33.015	R optimisation		Unit: %	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 1	min: 0 max: 200 Def: 100	Intrinsic value (**to be entered!**)
	If necessary, the start-up behaviour can be optimised using this parameter.			

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33.031	Motor current		Unit: A	
Relationship to parameter: 5.070	Parameter HB: S. xy	Transfer status: 1	min: 0 max: 150 Def: Type-specific	Intrinsic value (**to be entered!**)
	Hereby, the rated motor current $I_{M,N}$ is set for either star or delta connection.			

33.032	Motor power		Unit: W	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 1	min: 0 max: 55000 Def: Type-specific	Intrinsic value (**to be entered!**)
	A power value [W] $P_{M,N}$ that is equal to the rated motor power must be set here.			

33.034	Motor speed		Unit: rpm	
Relationship to parameter: 34.120 5.075	Parameter HB: S. xy	Transfer status: 1	min: 0 max: 10000 Def: Type-specific	Intrinsic value (**to be entered!**)
	Here, the rated motor speed $n_{M,N}$ from the type plate data of the motor should be entered.			

33.035	Motor frequency		Unit: Hz	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 1	min: 40 max: 100 Def: Type-specific	Intrinsic value (**to be entered!**)
	The rated motor frequency $f_{M,N}$ is set here.			

33.050	Stator resistance		Unit: Ohm	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 1	min: 0 max: 30 Def: Type-specific	Intrinsic value (**to be entered!**)
	Here, the stator resistance can be optimised if the automatically determined value (on the motor identification) is not sufficient.			

33.105	Leakage inductance		Unit: H	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 1	min: 0 max: 100 Def: 0	Intrinsic value (**to be entered!**)
	Only for asynchronous motors. Here, the leakage inductance can be optimised if the automatically determined value (on the motor identification) is not sufficient.			

33.110	Motor voltage		Unit: V	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 1	min: 0 max: 680 Def: Type-specific	Intrinsic value (**to be entered!**)
	Only for asynchronous motors. Hereby, the rated motor voltage $U_{M,N}$ is set for either star or delta connection.			

33.111	Motor-cos phi		Unit: 1	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 1	min: 0.5 max: 1 Def: Type-specific	Intrinsic value (**to be entered!**)
	Only for asynchronous motors. Here, the power factor cosphi should be entered from the type plate data of the motor.			

33.200	Stator inductance		Unit: H	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 1	min: 0 max: 100 Def: 0	Intrinsic value (**to be entered!**)
	Only for synchronous motors. Here, the stator inductance can be optimised if the automatically determined value (on the motor identification) is not sufficient.			

33.201	Rated flow rate		Unit: mVs	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 1	min: 0 max: 5000 Def: 0	Intrinsic value (**to be entered!**)
	Only for synchronous motors. Here, the rated flow rate can be optimised if the automatically determined value (on the motor identification) is not sufficient.			

7.4.2 I²T

33.010	I²T factor of the motor		Unit: %	
Relationship to parameter: 33.031 33.101	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 1000 Def: 0	Intrinsic value (**to be entered!**)
	Here, the percentage of current threshold (based on the motor current 33.031) can be adjusted at the start of integration.			

33.011	I²T time		Unit: s	
Relationship to parameter: 33.100	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 1200 Def: 25	Intrinsic value (**to be entered!**)
	Time after which the drive controller turns off with I²T.			

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33.138	Holding current time		Unit: s	
Relationship to parameter: 33.100	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 128000 Def: 2	Intrinsic value (**to be entered!**)
	Only for asynchronous motors. Is the time interval during which the drive is maintained with direct current after stoppage of the braking ramp.			

7.4.3 Switching frequency

The internal switching frequency (clock frequency) can be varied to control the power unit. A high setting value leads to noise reduction in the motor, but also to increased EMC emission and higher losses in the drive controller.

34.030	Switching frequency		Unit: Hz	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 2	min: 1 max: 4 Def: 2	Intrinsic value (**to be entered!**)
	Selecting the switching frequency of the inverter. 1 = 16 kHz 2 = 8 kHz 4 = 4 kHz			

7.4.4 Controller data

34.010	Control mode		Unit: integer	
Relationship to parameter: 33.001 34.011	Parameter HB: S. xy	Transfer status: 2	min: 100 max: 201 Def: 100	Intrinsic value (**to be entered!**)
	Selection of the control mode. 100 = open-loop asynchronous motor 101 = close-loop asynchronous motor 200 = open-loop synchronous motor 201 = close-loop synchronous motor			

34.011	Encoder type		Unit: integer	
Relationship to parameter: 34.010 34.012 34.013	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 2 Def: 0	Intrinsic value (**to be entered!**)
	Selection of encoder type. 0 = inactive 1 = TTL encoder 2 = HTL encoder **NOTICE! When selecting the HTL encoder, 24V is outputted over the interface. This could lead to the destruction of the encoder when using a TTL encoder.**			

34.012	Encoder lines		Unit: integer	
Relationship to parameter: 34.010 34.011 34.013	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 10000 Def: 1024	Intrinsic value (**to be entered!**)
	Selection of the lines of the encoder used.			

34.013	Encoder offset		Unit: °	
Relationship to parameter: 34.010 34.011 34.012	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 360 Def: 0	Intrinsic value (**to be entered!**)
	Here, an encoder offset can be set for the encoder.			

34.021	Snap option		Unit: integer	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 1	min: 0 max: 1 Def: 1	Intrinsic value (**to be entered!**)
	Using this parameter, the snap option is activated. 0 = inactive 1 = active			

34.090	n-controller K_P		Unit: mA/rad/s	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 10000 Def: 150	Intrinsic value (**to be entered!**)
	Here, the controller gain of the speed controller can be optimised if the automatically determined results (on the motor identification) are not sufficient.			

34.091	n-controller T_N		Unit: s	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 10 Def: 4	Intrinsic value (**to be entered!**)
	Here, the reset time of the speed controller can be optimised if the automatically determined results (on the motor identification) are not sufficient.			

34.110	Slip trimmer		Unit: integer	
Relationship to parameter: 33.034	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 1 Def: 0	Intrinsic value (**to be entered!**)
	Only for asynchronous motors. Using this parameter, the slip compensation can be optimised or deactivated. 0 = deactivated (behaviour as on the mains) 1 = the slip is compensated.			

34.130	Voltage control reserve		Unit:	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 2 Def: 0.95	Intrinsic value (**to be entered!**)
	Only for asynchronous motors. The voltage output can be adapted using this parameter.			

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7.4.5 Square-law characteristic

34.120	Square-law characteristic		Unit: integer	
Relationship to parameter: 34.121	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 1 Def: 0	Intrinsic value (**to be entered!**)
	Only for asynchronous motors. Here, the function of the square-law characteristic can be activated. 0 = inactive 1 = active			

34.121	Flow adjustment		Unit: %	
Relationship to parameter: 34.120	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 100 Def: 50	Intrinsic value (**to be entered!**)
	Only for asynchronous motors. The percentage by which the flow should be reduced can be set here. Very large changes during operation may cause an overvoltage trip.			

7.4.6 Controller data for synchronous motor

34.225	Field weakening		Unit: integer	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 1 Def: 0	Intrinsic value (**to be entered!**)
	Only for synchronous motors. 0 = inactive, the motor cannot be run in the weakened field. 1 = active, the motor can be brought into the weakened field until the inverter has reached its current limit or the max. permissible EMC is achieved.			

34.226	Starting current		Unit: %	
Relationship to parameter: 34.227	Parameter HB: S. xy	Transfer status: 2	min: 5 max: 1000 Def: 25	Intrinsic value (**to be entered!**)
	Only for synchronous motors. The flow which is set in the motor prior to its start can be adjusted here. Value in % of the rated motor current.			

34.227	Initialisation time		Unit: s	
Relationship to parameter: 34.226	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 100 Def: 0.25	Intrinsic value (**to be entered!**)
	Only for synchronous motors. The time in which the starting current 34.226 is applied can be set here.			

34.228 – 34.230	Start-up behaviour		Unit: integer	
Relationship to parameter:	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 1 Def: 0	Intrinsic value (**to be entered!**)
	Only for synchronous motors. Larger starting torques can be achieved by changing the start-up procedure to the "controlled" mode. 0 = regulated, the inverter switches directly to the control mode after the setting phase. 1 = controlled, following the setting phase, the field of rotation is increased to the starting frequency 34.230 controlled with the start-up ramp 34.229, then it is switched to the regulation mode.			

7.4.7 Field bus

6.060	Set field bus address		Unit: integer	
Relationship to parameter: 6.061, 6.062	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 127 Def: 0	Intrinsic value (**to be entered!**)
	Only for synchronous motors. The time in which the starting current 34.226 is applied can be set here.			

6.061	Set field bus baud rate		Unit: integer	
Relationship to parameter: 6.060, 6.062	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 8 Def: 2	Intrinsic value (**to be entered!**)
	CanOpen applies: 0 = 1 MBit, 2 = 500 kBit, 3 = 250 kBit, 4 = 125 kBit, 6 = 50 kBit, 7 = 20 kBit, 8 = 10 kBit			

6.062	Set bus timeout		Unit: integer	
Relationship to parameter: 1.130	Parameter HB: S. xy	Transfer status: 2	min: 0 max: 100 Def: 5	Intrinsic value (**to be entered!**)
	Bus timeout in seconds. The timeout counter is activated when the bus has been selected for the setpoint source of the motor current and a setpoint is given unequal to "0". The timeout is deactivated at 0 = > bus timeout.			

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In this chapter, you will find

- Display of the LED flash codes for error detection
- Description of error detection using PC tools
- List of errors and system errors
- Notes on error detection using the HAND-HELD UNIT MMI

⚠ WARNING

Risk of injury and danger of electric shock!
The non-observance of warnings can result in severe bodily injury or substantial property damage.

1. Repairs on the device may only be carried out by the manufacturer.
2. Any defective parts or components must be replaced using parts included in the relevant spare parts list.
3. Prior to opening, assembly or disassembly, the drive controller must be unlocked.

8.1 Display of the LED flash codes for error detection

When an error occurs, the LEDs on the drive controller display a flash code via which the error can be diagnosed.

The following table gives an overview.

LED flash codes

Red LED	Green LED	Status
✳	○	Bootloader active (flashing alternately)
○	✳	Ready for operation (enable En_HW for operation)
○	●	Operation
✳	●	Warning
●	○	Error
●	●	Motor data label
○	✳	Initialisation
✳	✳	Firmware update
✳	●	Bus error operation
✳	✳	Bus error ready for operation

○ LED off
● LED on
✳ LED flashes
✳ LED flashes quickly

8.2 List of errors and system errors

When an error occurs, the inverter switches off; for the corresponding error numbers, refer to the flash code table or the PC tool.

Error messages can only be acknowledged when the error is no longer present.

! Error messages can be acknowledged as follows:

1. Digital input (programmable)
2. via the hand-held unit MMI
3. Automatic acknowledgement (parameter 1,181)
4. Switching the device on and off
5. via fieldbus (CANOpen, Profibus DP, EtherCAD)

Below is a list of possible error messages. For errors not listed here, please contact the manufacturer.

Error detection

No.	Error name	Error description	Possible cause / remedy
1	Low voltage 24 V application	Supply voltage of the application is less than 15 V	Overload of the 24 V supply
2	Over-voltage 24 V application	Supply voltage of the application is greater than 31 V	Internal 24 V supply is not OK or external power supply is not OK
3	Version error of client PLC	The version of the client PLC does not match the device firmware	Check the version numbers of the customer PLC and device firmware
4	Communication application<>performance	The internal communication between the application and power printed circuit board is out of order	EMC interference
5	Parameters distributor	The internal distribution of the parameters during the initialisation has failed	Parameter set is incomplete
6	Timeout performance	The power unit does not respond	Operation with 24 V without power supply
7	Cable breakage analogue input 1 (4 - 20 mA / 2 - 10 V)	Current or voltage is less than the lower limit of the analogue input 1 (this error monitoring is activated by setting the parameter 4,021 to 20%)	Cable breakage, defective external sensor
8	Cable breakage analogue input 2 (4 - 20 mA / 2 - 10 V)	Current or voltage is less than the lower limit of the analogue input 2 (this error monitoring is activated by setting the parameter 4,021 to 20%)	Cable breakage, defective external sensor
9	Blocking detection	The drive shaft of the motor is blocked. 5.080	Remove blockage
10	Overtemperature of drive controller application	Internal temperature too high	Insufficient cooling, low speed and high torque, clock frequency too high
11	Bus timeout	No response from the bus device or HAND-HELD UNIT MMI / PC	Check bus wiring
12	Confirmation error	The number of max. automatic acknowledgements (1,182) has been exceeded	Check the error history and eliminate errors
13	External error 1	The parametrised error input is	Eliminate external error

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No.	Error name	Error description	Possible cause / remedy
		active. 5.010	
14	External error 2	The parametrised error input is active. 5.011	Eliminate external error
15	Motor recognition	Motor identification errors	Check the connections to the drive controller / motor and PC / MMI hand-held unit / the drive controller! Restart of the motor identification!
16	IGBT trip	Protection of the IGBT module from overcurrent has been triggered	Short circuit in motor or motor cable / controller settings
17	Intermediate circuit over-voltage	The maximum intermediate circuit voltage has been exceeded	Recovery through motor in re-generative operation / mains voltage too high / incorrect set-ting of the speed controller / braking resistor is not con-nected or defective / ramp times too short
18	Intermediate circuit under-voltage	The minimum intermediate circuit voltage was not reached	Mains voltage too low / mains defective / check wiring
19	Motor overtemperature	Motor PTC has been triggered	Overload of the motor (e.g. high torque at low speed) / ambient temperature too high
20	Interruption in mains supply		One phase missing / mains volt-age supply is interrupted
21	IGBT module overtempera-ture	IGBT module overtemperature	Insufficient cooling, low speed and high torque, clock fre-quency too high
22	Overcurrent	Maximum output current of the inverter exceeded	Cooling insufficient / low speed and high torque / clock fre-quency too high / ramp times too small / brake not opened
23	Drive controller overtem-perature	Internal temperature too high	Cooling insufficient / low speed and high torque / clock fre-quency too high / continuous overload / reduce ambient tem-perature / check fan
24	I^2T motor protection switch-off	The internal I^2T motor protection (parametrisable) has been triggered	Continuous overload
25	Grounding	Grounding of a motor phase	Insulation fault
26	Motor connection inter-rupted	No motor current despite control by the drive controller	No motor connected
27	Motor parameter	Plausibility check of the motor pa-rameters has failed	Parameter set not OK
28	Drive controller parameters	Plausibility check of the drive con-troller parameters has failed	Parameter set not OK, motor type 33,001 and control mode 34,010 not plausible
29	Type plate data	No motor data has been entered.	Enter motor data according to the rating plate
30	Limitation of power classes	Max. overload of the drive controller exceeded for more than 60 sec-onds.	Check application / reduce load / scale-up the drive controller size

9.1 General data

Technical data 400 V devices

Size	MA	MB			MC		MD			
Recommended motor power (4 -pin asynchronous motor)	1,5	2,2	3,0	4,0	5,5	7,5	11,0	15,0	18,5	22,0
Ambient temperature	**-25°C** [-13°F] (non-condensing) up to **+50°C** [+122°F] (without derating) *									
Mains voltage[V]	3~ 400 -10% – 480 +10%									
Mains frequency [Hz]	47 – 63									
Line system configurations	TN/TT									
Mains current [A]	3,3	4,6	6,2	7,9	10,8	14,8	23,2	28,2	33,2	39,8
Rated current, effective [IN at 8 kHz / 400 V]	4,0	5,6	7,5	9,5	13,0	17,8	28,0	34,0	40,0	48,0
Minimum braking resistance [Ω]	100	50			50		30			
Maximum overload	150% of rated current for 60 s									130%
Switching frequency [kHz]	4, 8, 16 (factory setting 8)									
Cyclic frequency [Hz]	0 – 400									
Protection function	Over/undervoltage, I^2t limitation, short circuit, motor inverter temperature, anti-tilt protection, anti-lock system									
Process control	Freely configurable PID controller									
Dimensions L x B x H [mm]	233 x 153 x 120	270 x 189 x 140			307x223x181		414 x 294 x 232			
Weight including adapter plate [kg]	3,9	5,0			8,7		21,0			
Protection class [IPxy]	65						55			
EMC	met according to DIN EN 61800-3, class C2									

*according to UL standard 508C, see UL Specification (English version) [➙ 72].

Designation	Function
Digital inputs 1-4	- Switching level low < 5V / high > 15 V - Imax (at 24 V) = 3mA - Rin = 8.6 kOhm
Analogue inputs 1, 2	- Input +/- 10V or 0 - 20mA - input 2 - 10V or 4 - 20mA - resolution 10 bit - Rin = 10kOhm
Digital outputs 1, 2	- Short-circuit-proof - Imax = 20 mA
Relay 1, 2	1 changeover contact (NO/ NC) maximum switching power*: - for resistive load (cos j = 1): 5 A ~ 230 V or 30 V - at inductive load (cos j = 0.4 and L/ R = 7 ms): 2 A ~ 230 V or = 30 V maximum response time: 7 ms ± 0.5 ms electric service life: 100,000 switching cycles
Analogue output 1 (current)	- Short-circuit-proof - I output = 0 to 20 mA output load = 500 Ohm

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Designation	Function
Analogue output 1 (voltage)	- Short-circuit-proof - Uoutput = 0..10V - Imax = 10 mA
Voltage supply 24 V	- Auxiliary voltage U = 24 V DC - short-circuit-proof - Imax = 100 mA - external 24 V supply possible
Voltage supply 10 V	- Auxiliary voltage U = 10 V DC - short-circuit-proof - Imax = 30 mA

*According to UL standard 508C, max. 2 A is permitted

9.2 Derating of output power

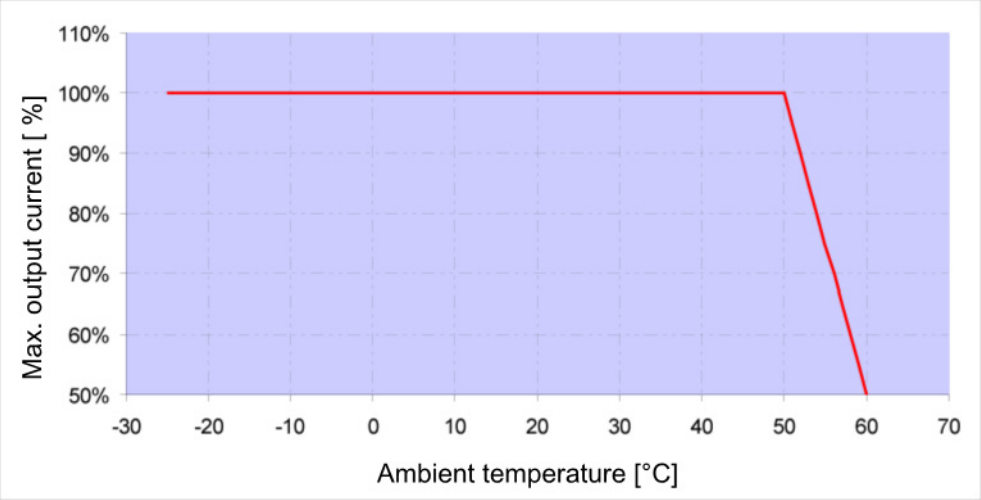
The drive controllers are equipped with two built-in PTC resistors (positive temperature coefficient thermistors) that monitor both the cooling element as well as the internal temperature. Once an allowable IGBT temperature of 95 °C or an allowable internal temperature of 85 °C is exceeded, the drive controller switches off.

Drive controllers in the power range 1.5 kW - 18.5 kW are designed for an overload of 150% for 60 s (every 10 minutes), the drive controller with rated power of 22 kW for an overload of 130% for 60 s (every 10 min.). For these conditions, reduction of the overload capacity or its time is to be taken into account:

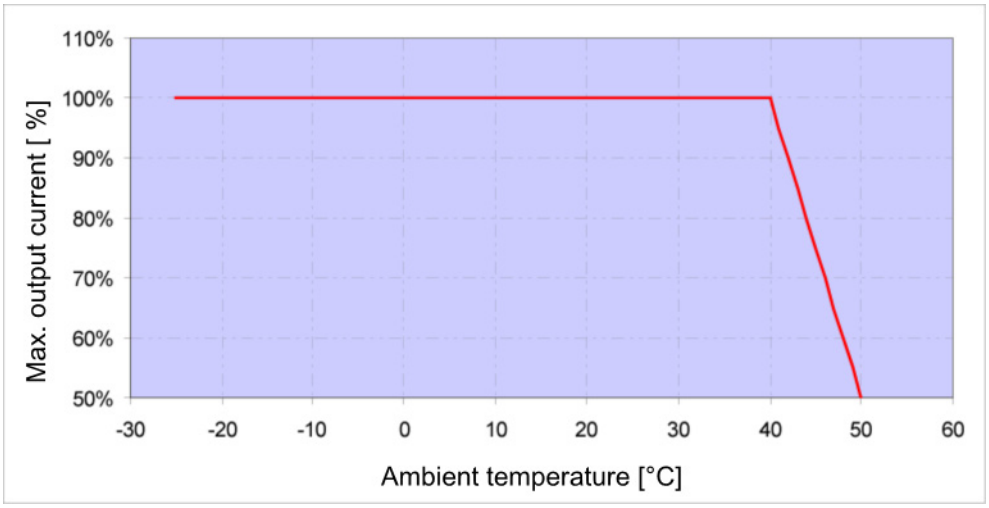
- A clock frequency set permanently too high > 8 kHz (depending on load).
- A permanently increased cooling element temperature, caused by a blocked air flow or a thermal block (dirty cooling ribs).
- Depending on the installation type, permanently too high ambient temperature.

The respective max. output values can be defined, based on the following characteristic curves.

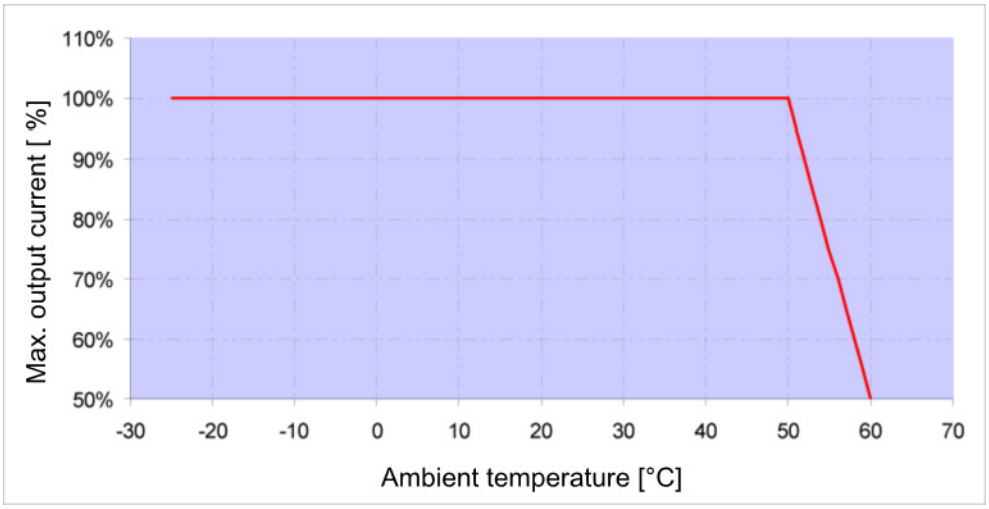
9.2.1 Derating through increased ambient temperature



Derating for motor-mounted drive controllers (all sizes)



Derating for wall-mounted drive controllers (sizes A - C)



Derating for wall-mounted drive controllers (size C with optional fan and size D)

9.2.2 Derating due to installation altitude

The following applies to all drive controllers:

- In S1 mode, no power reduction is required up to 1,000 m above sea level.
- In the range from 1,000 m up to and including 2000 m, power reduction of 1% is required for every 100 m installation altitude. An overvoltage category 3 is observed!
- In the range from 2,000 m up to and including 4,000 m, the overvoltage category 2 must be observed due to the lower air pressure!

To comply with the overvoltage category:

- an external surge protector should be used in the mains supply line to the drive controller.
- the input voltage should be reduced.

Please contact the manufacturer.

The respective max. output values can be defined, based on the following characteristic curves.

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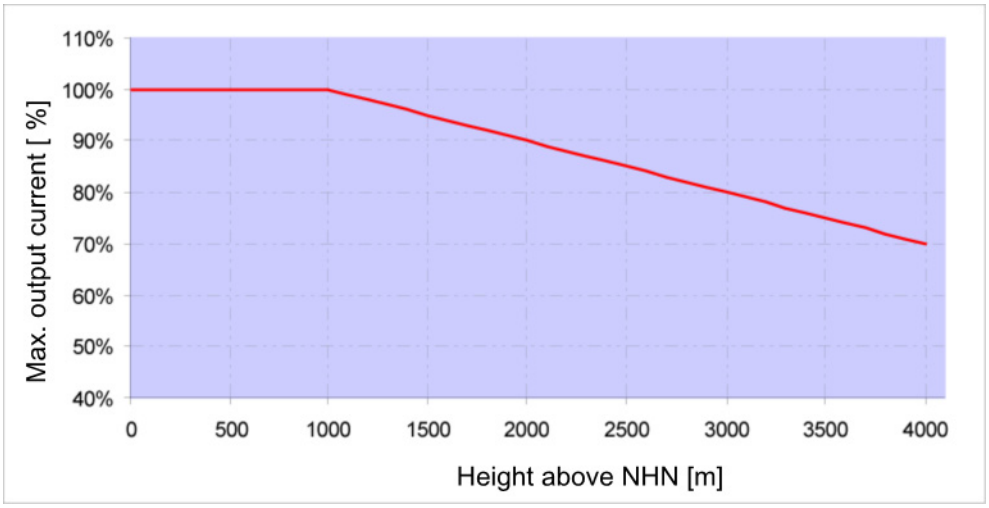
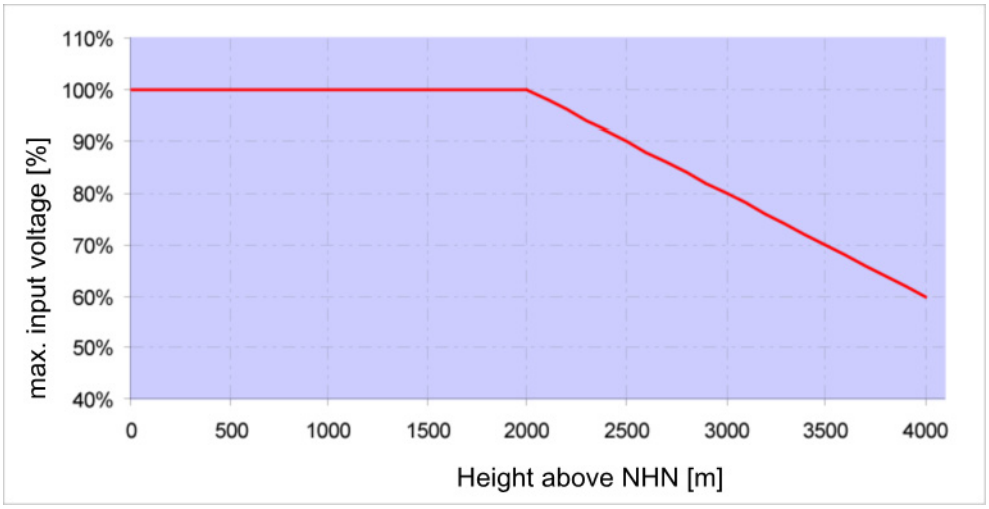


Derating of the maximum output current due to the installation altitude



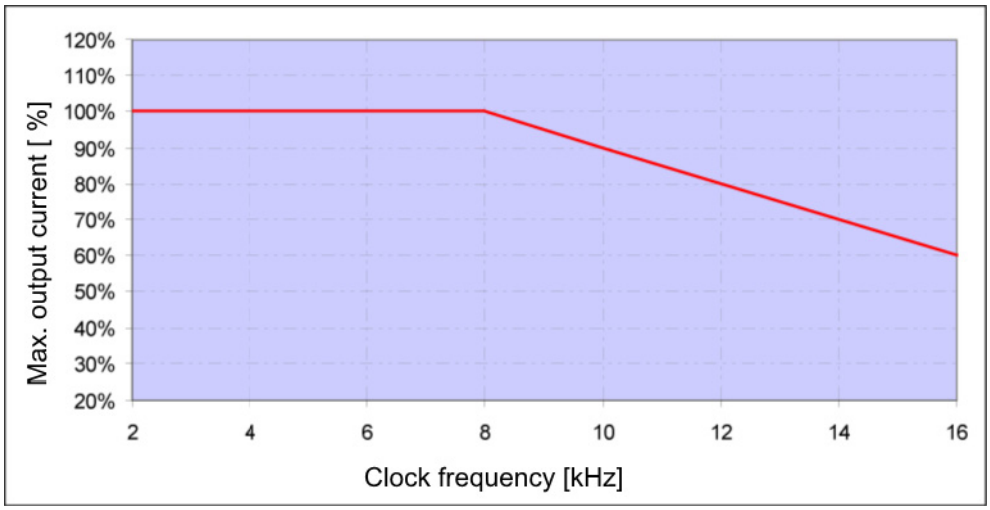
Derating of the maximum input voltage due to the installation altitude

9.2.3 Derating due to the clock frequency

The following illustration shows the output current as a function of the clock frequency. In order to limit the heat losses in the drive controller, the output current must be reduced.

Note: There is no automatic reduction of the clock frequency!

The max. output values can be defined, based on the following characteristic curve.



Derating of the maximum output current due to the clock frequency

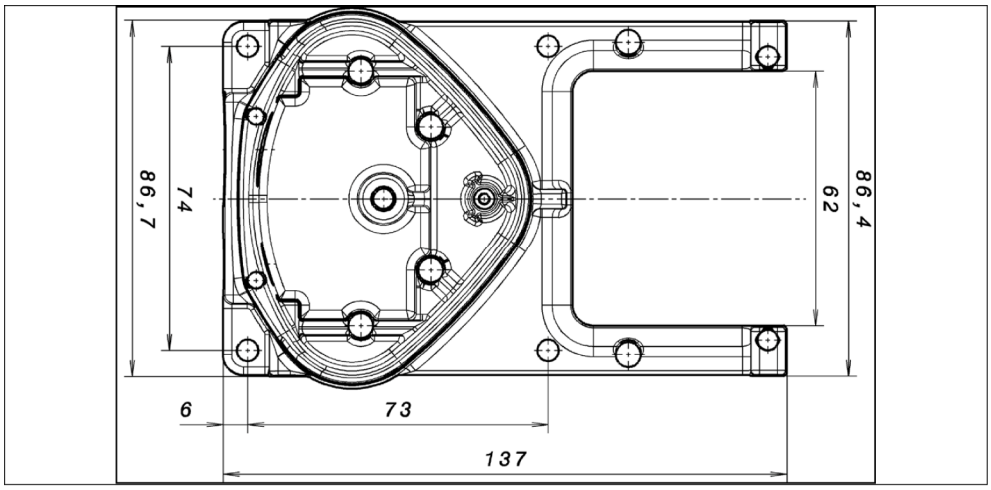
In this section, you will find brief descriptions of the following optional accessories

- Adapter plates
- Hand-held unit MMI, including connection cable RJ11 to connector M12

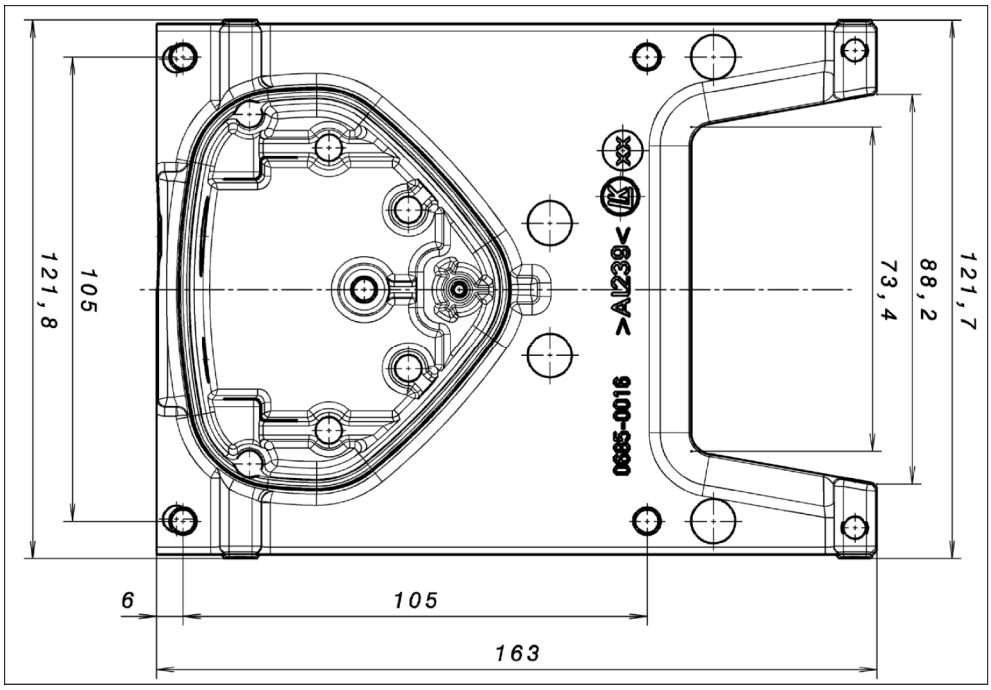
10.1 Adapter plates

For each DRIVE CONTROLLER size, there is a standard wall-mounted adapter plate (with integrated adapter board for BG A to BG C).
Download the 3D files for the drive controller and adapter plates at www.gd-elmorietschle.com.
Four holes are available for mounting the adapter plate, as well as an EMC cable gland.

Drive controller size	A	B	C	D
Power [kW]	1,5	2,2 – 4,0	5,5 – 7,5	11,0 – 22,0
Designation	2FX1619-0ER00	2FX1649-0ER00	2FX1669-0ER00	2FX1699-0ER00
Part no.	1650001619	1650001649	1650001669	1650001699



Drill pattern of standard wall-mounted adapter plate BG A



Drill pattern of standard wall-mounted adapter plate BG B

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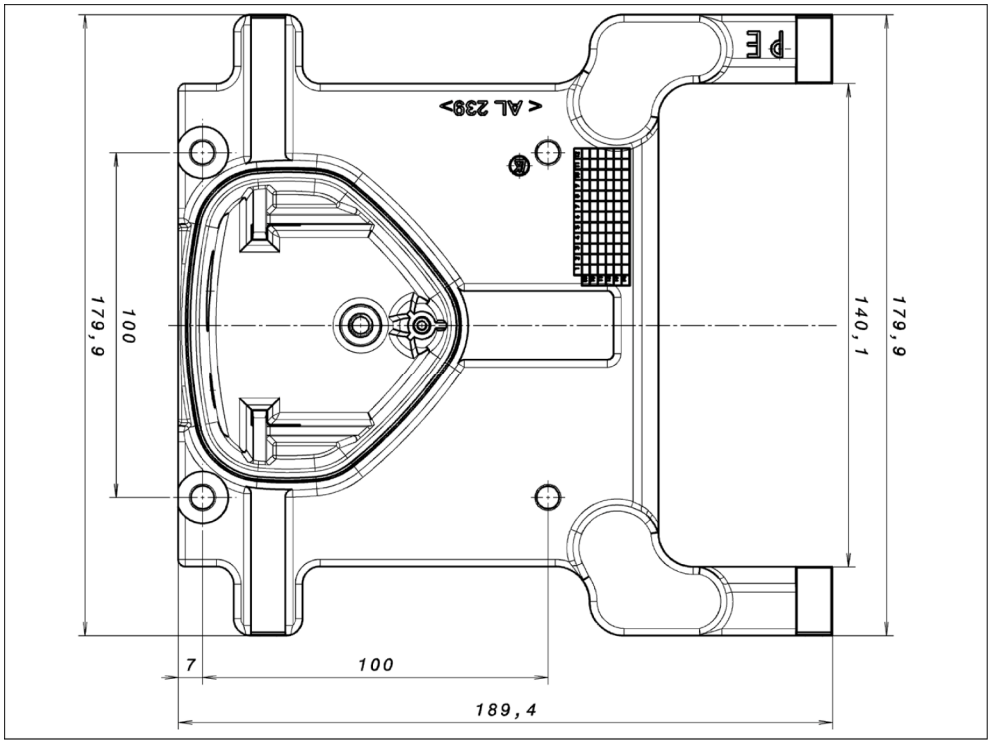
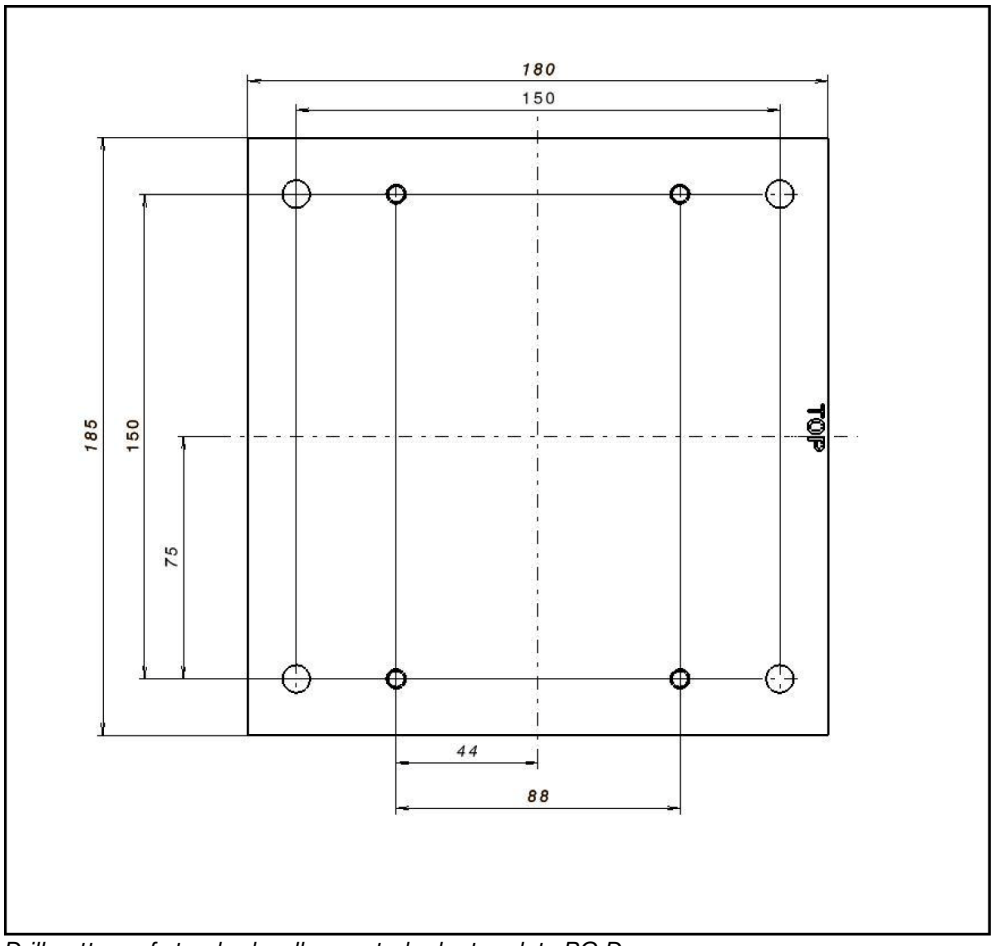


Drill pattern of standard wall-mounted adapter plate BG C



Drill pattern of standard wall-mounted adapter plate BG D

10.2 Hand-held unit MMI, including 3 m connection cable RJ11 to connector M12

The hand-held unit MMI 2FX4520-0ER00 is a purely industrial product (accessory) which may only be used in conjunction with a DRIVE CONTROLLER! The HAND-HELD UNIT MMI is connected to the integrated M12 interface of the drive controller. By means of this control unit, the user is able to write (program) and/or display all parameters of the drive controller. Up to 8 complete records can be stored in a HAND-HELD UNIT MMI and copied to other DRIVE CONTROLLERS. As an alternative to free PC software, complete commissioning is possible, external signals are not necessary.

10.3 PC communication cable USB to connector M12 (RS485/RS232 converter integrated)

As an alternative to the MMI hand-held unit, a drive control can also be commissioned with the help of the PC adapter 2FX4521-0ER00 and the PC software. The PC software is available to you free of cost on the manufacturer homepage under www.gd-elmorietschle.com.

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This chapter contains information about electromagnetic compatibility (EMC), and guidelines, norms and standards.

For binding information about the relevant drive control approvals, please refer to the relevant type plate!

11.1 EMC limit classes

Please note that EMC limit classes are only reached if the standard switching frequency (clocking frequency) of 8 kHz is complied with. Depending on the installation material used and/or extreme ambient conditions, it might be necessary to use additional sheath wave filters (ferrite rings). If the device is mounted on the wall, the length of the shielded motor cables (with large surfaces on both sides) (max. 3 m) may not exceed the permitted limits.

Wiring suitable for EMC also requires that EMC screw connections be used on both sides (drive control and motor).

NOTICE

In a residential environment, this product can cause high-frequency disruptions that may require interference suppression measures.

11.2 Classification acc. to IEC/EN 61800-3

The generic standard defines test procedures and severity levels for every environment in the drive control category; these have to be complied with.

Definition of environment

First environment (residential, commercial and industrial area):

All “areas” that are directly supplied by a public low-voltage connection, such as:

- Residential area, e.g. houses, apartments etc.
- Retail area, e.g. shops, supermarkets
- Public institutions, e.g. theatres, stations
- Outside areas, e.g. petrol stations and parking areas
- Light industry, e.g. workshops, laboratories, small businesses

Second environment (industry):

Industrial surroundings with their own supply network that is separated from the public low-voltage supply by a transformer.

11.3 Standards and guidelines

The following specifically apply:

- Directive on Electromagnetic Compatibility (Directive 2004/108/EC of the Council EN 61800-3:2004)
- Low Voltage Directive (Directive 2006/95/EC of the Council EN 61800-5-1:2003)
- Product standards list

11.4 Approval according to UL

11.4.1 UL Specification (English version)

Maximum Ambient Temperature (without models Suffix S10):

Electronic	Adapter	Ambient	Suffixe
INV MA 2 0.37	ADP MA WDM	45° C	-
INV MA 2 0.55	ADP MA WDM	45° C	-
INV MA 2 0.75	ADP MA WDM	45° C	-
INV MA 2 1.10	ADP MA WDM	40° C	-
INV MA 4 1.50	ADP MA WDM	40° C	-
INV MB 4 2.2	ADP MB WDM	45° C	-
INV MB 4 3.0	ADP MB WDM	40° C	-
INV MB 4 4.0	ADP MB WDM	35° C	-
INV MC 4 5.5	ADP MC WDM	40° C	Gx0
INV MC 4 7.5	ADP MC WDM	35° C	Gx0
INV MC 4 5.5	ADP MC WDM	55° C	Gx1
INV MC 4 7.5	ADP MC WDM	50° C	Gx1
INV MC 4 5.5	ADP MC WDM	50° C	Gx2
INV MC 4 7.5	ADP MC WDM	45° C	Gx2
INV MD 4 11.0	ADP MD WDM	55° C	-
INV MD 4 15.0	ADP MD WDM	50° C	-
INV MD 4 18.5	ADP MD WDM	40° C	-
INV MD 4 22.0	ADP MD WDM	35° C	-

Maximum Surrounding Temperature:

Electronic	Adapter	Ambient	Suffixe
INV MC 4 5.5	ADP MC WDM	40° C	S10
INV MC 4 7.5	ADP MC WDM	35° C	S10

Required Markings

Enclosure intended for use with field-installed conduit hubs, fittings or closure plates UL approved in accordance to UL514B and CSA certified in accordance to C22.2 No. 18, environmental Type 1 or higher.

The INVEOR INV MC 4 with suffix S10 is for use in Pollution Degree 2 only.

Internal Overload Protection Operates within 60 seconds when reaching 150 % of the Motor Full Load Current

Suitable for use on a circuit capable of delivering not more than 5 kA rms symmetrical amperes, 230 Volts for INV Mx 2 or 480 Volts for INV Mx 4, maximum when protected by fuses.

“Warning” – Use fuses rated 600 V/50 A for INV MA 2 only.

“Warning” – Use fuses rated 600 V/10 A for INV MA 4 only.

“Warning” – Use fuses rated 600 V/30 A for INV MB 4 only.

“Warning” – Use fuses rated 600 V/30 A for INV MC 4 only.

“Warning” – Use fuses rated 600 V/70 A for INV MD 4 only.

Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Manufacturer Instructions, National Electrical Code and any additional local codes.

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All wiring terminals marked to indicate proper connections for the power supply, load and control circuitry.

The tightening, torque to connect the motor terminals, is 26.55 IB/in (size A to C) and 5.31 lb/in to connect the PTC (in all sizes).

Instruction for operator and servicing instructions on how to mount and connect the products using the intended motor connection adapter, please see Installing the drive controller integrated in the motor [→ 18] **and** Adapter plates [→ 68] **in the operating manual.**

Use 75° C copper wires only.

Drives do not provide over temperature sensing.

For Mx 4 used in Canada: TRANSIENT SURGE SUPPRESSION SHALL BE INSTALLED ON THE LINE SIDE OF THIS EQUIPMENT AND SHALL BE RATED 277 V (PHASE TO GROUND), 480 V (PHASE TO PHASE), SUITABLE FOR OVERVOLTAGE CATEGORY III, AND SHALL PROVIDE PROTECTION FOR A RATED IMPULSE WITHSTAND VOLTAGE PEAK OF 2.5 kV

Maximum Surrounding Temperature (sandwich version):

Electronic	Overall heatsink dimensions	Surrounding	Suffix
INV MA 2 0.37	(150x27x210) mm	50° C	Gx3
INV MA 2 0.55	(150x27x210) mm	50° C	Gx3
INV MA 2 0.75	(150x27x210) mm	50° C	Gx3
INV MA 2 1.10	(150x27x210) mm	50° C	Gx3
INV MA 4 0.55	(150x27x210) mm	65° C	Gx3
INV MA 4 0.75	(150x27x210) mm	65° C	Gx3
INV MA 4 1.10	(150x27x210) mm	65° C	Gx3
INV MA 4 1.50	(150x27x210) mm	65° C	Gx3
INV MB 4 2.2	(200x40x250) mm	60° C	Gx3
INV MB 4 3.0	(200x40x250) mm	60° C	Gx3
INV MB 4 4.0	(200x40x250) mm	60° C	Gx3
INV MC 4 5.5	(216x83x300) mm	65° C	Gx3
INV MC 4 7.5	(216x83x300) mm	65° C	Gx3
INV MD 4 11.0	to be defined	to be defined	Gx3
INV MD 4 15.0	to be defined	to be defined	Gx3
INV MD 4 18.5	to be defined	to be defined	Gx3
INV MD 4 22.0	to be defined	to be defined	Gx3

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CONDITIONS OF ACCEPTABILITY:

Use - For use only in complete equipment where the acceptability of the combination is determined by Underwriters Laboratories Inc.

1. These drives are incomplete in construction and have to be attached to an external heatsink in the end-use. Unless operated with the heatsink as noted in item 2 of the conditions of acceptability below, temperature test shall be conducted in the end-use.
2. Temperature test was conducted with drive installed on aluminum heatsink, overall dimensions and ribs shape as outlined below:
3. Suitability of grounding for the combination of drive and heatsink needs to be verified in accordance with the end-use standard.
4. Temperature test was not conducted on models INV MD 4. Suitability of drive - heatsink combination shall be determined by subjecting to temperature test in the end-use.

Required Markings

Internal Overload Protection Operates within 60 seconds when reaching 150 % of the Motor Full Load Current.

Suitable for use on a circuit capable of delivering not more than 5 kA rms symmetrical amperes, 230 Volts for INV Mx 2 or 480 Volts for INV Mx 4, maximum when protected by fuses.

“Warning” – Use fuses rated 600 V/50 A for INV MA 2 only.

“Warning” – Use fuses rated 600 V/10 A for INV MA 4 only.

“Warning” – Use fuses rated 600 V/30 A for INV MB 4 only.

“Warning” – Use fuses rated 600 V/30 A for INV MC 4 only.

“Warning” – Use fuses rated 600 V/70 A for INV MD 4 only.

Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Manufacturer Instructions, National Electrical Code and any additional local codes.

All wiring terminals marked to indicate proper connections for the power supply, load and control circuitry.

Instruction for operator and servicing instructions on how to mount and connect the products using the intended motor connection adapter, please see Installing the drive controller integrated in the motor [→ 18] **and** Adapter plates [→ 68] **in the operating manual.**

Use 75° C copper wires only.

Drives do not provide over temperature sensing.

For use in Pollution degree 2 only.

For Mx 4 used in Canada: TRANSIENT SURGE SUPPRESSION SHALL BE INSTALLED ON THE LINE SIDE OF THIS EQUIPMENT AND SHALL BE RATED 277 V (PHASE TO GROUND), 480 V (PHASE TO PHASE), SUITABLE FOR OVERVOLTAGE CATEGORY III, AND SHALL PROVIDE PROTECTION FOR A RATED IMPULSE WITHSTAND VOLTAGE PEAK OF 2.5 kV

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11.4.2 Homologation CL (Version en française)

Température ambiante maximale (sans modèles suffixe S10):

Électronic	Adaptateur	Ambiante	Suffixe
INV MA 2 0.37	ADP MA WDM	45° C	-
INV MA 2 0.55	ADP MA WDM	45° C	-
INV MA 2 0.75	ADP MA WDM	45° C	-
INV MA 2 1.10	ADP MA WDM	40° C	-
INV MA 4 1.50	ADP MA WDM	40° C	-
INV MB 4 2.2	ADP MB WDM	45° C	-
INV MB 4 3.0	ADP MB WDM	40° C	-
INV MB 4 4.0	ADP MB WDM	35° C	-
INV MC 4 5.5	ADP MC WDM	40° C	Gx0
INV MC 4 7.5	ADP MC WDM	35° C	Gx0
INV MC 4 5.5	ADP MC WDM	55° C	Gx1
INV MC 4 7.5	ADP MC WDM	50° C	Gx1
INV MC 4 5.5	ADP MC WDM	50° C	Gx2
INV MC 4 7.5	ADP MC WDM	45° C	Gx2
INV MD 4 11.0	ADP MD WDM	55° C	-
INV MD 4 15.0	ADP MD WDM	50° C	-
INV MD 4 18.5	ADP MD WDM	40° C	-
INV MD 4 22.0	ADP MD WDM	35° C	-

Température environnante maximale :

Électronic	Adaptateur	Ambiante	Suffixe
INV MC 4 5.5	ADP MC WDM	40° C	S10
INV MC 4 7.5	ADP MC WDM	35° C	S10

Mentions requises

Boîtier prévu pour une utilisation avec entrées de conduit filetées installées sur le terrain, raccords ou plaques d'obturation approuvées UL conformément à UL514B et certifiées CSA conformément à C22.2 No. 18, étiquetage environnemental de type 1 ou plus.

Le variateur INVEOR INV MC 4 avec le suffixe S10 est exclusivement conçu pour une utilisation en environnement de degré de pollution 2.

La protection interne contre les surcharges se met en marche en l'espace de 60 secondes une fois 150 % du courant nominal du moteur atteints

Convient pour une utilisation sur un circuit capable de livrer pas plus de 5 kA ampères symétriques rms, 230 volts pour INV Mx 2 ou 480 volts pour INV Mx 4 maximum en cas de protection par fusibles.

« Avertissement » – Utiliser des fusibles d'une valeur nominale de 600 V/50 A pour INV MA 2 uniquement.

« Avertissement » – Utiliser des fusibles d'une valeur nominale de 600 V/10 A pour INV MA 4 uniquement.

« Avertissement » – Utiliser des fusibles d'une valeur nominale de 600 V/30 A pour INV MB 4 uniquement.

« Avertissement » – Utiliser des fusibles d'une valeur nominale de 600 V/30 A pour INV MC 4 uniquement.

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« Avertissement » – Utiliser des fusibles d'une valeur nominale de 600 V/70 A pour INV MD 4 uniquement.

La protection intégrée contre les courts-circuits à semi-conducteur n'assure pas la protection du circuit de dérivation. Le circuit de dérivation doit être protégé conformément aux instructions du fabricant, au code national d'électricité et à tout autre code local additionnel.

Toutes les bornes de câblage avec repères pour les connexions correctes pour l'alimentation électrique, la charge et les circuits de commande.

Le couple de serrage pour la connexion des bornes du moteur est de 26,55 lb/in (taille A à C) et de 5,31 lb/in pour la connexion CTP (toutes les tailles).

Pour les instructions destinées à l'opérateur et les instructions de service relatives au montage et à la connexion des produits à l'aide de l'adaptateur de connexion du moteur prévu à cet effet, voir les Installation du régulateur d'entraînement intégré au moteur [➙ 18] **et** Plaques adaptatrices [➙ 68] **contenus dans le Manuel d'utilisation.**

Utiliser uniquement des câbles en cuivre 75° C.

Les entraînements ne permettent pas la détection de surtempérature.

Concernant le Mx 4 utilisé au Canada : LA SUPPRESSION DE TENSION TRANSITOIRE DOIT ÊTRE INSTALLÉE CÔTÉ LIGNE DE CET ÉQUIPEMENT ET AVOIR UNE VALEUR NOMINALE DE 277 V (PHASE-TERRE), 480 V (PHASE-PHASE), EN COMPATIBILITÉ AVEC LA CATÉGORIE DE SURTENSION III, ET DOIT OFFRIR UNE PROTECTION CONTRE UN PIC DE TENSION ASSIGNÉE DE TENUE AUX CHOCS DE 2,5 kV

Température environnante maximale (version sandwich):

Électronic	Dimensions hors tout du dissipateur	Environnante	Suffixe
INV MA 2 0.37	(150x27x210) mm	50° C	Gx3
INV MA 2 0.55	(150x27x210) mm	50° C	Gx3
INV MA 2 0.75	(150x27x210) mm	50° C	Gx3
INV MA 2 1.10	(150x27x210) mm	50° C	Gx3
INV MA 4 0.55	(150x27x210) mm	65° C	Gx3
INV MA 4 0.75	(150x27x210) mm	65° C	Gx3
INV MA 4 1.10	(150x27x210) mm	65° C	Gx3
INV MA 4 1.50	(150x27x210) mm	65° C	Gx3
INV MB 4 2.2	(200x40x250) mm	60° C	Gx3
INV MB 4 3.0	(200x40x250) mm	60° C	Gx3
INV MB 4 4.0	(200x40x250) mm	60° C	Gx3
INV MC 4 5.5	(216x83x300) mm	65° C	Gx3
INV MC 4 7.5	(216x83x300) mm	65° C	Gx3
INV MD 4 11.0	to be defined	to be defined	Gx3
INV MD 4 15.0	to be defined	to be defined	Gx3
INV MD 4 18.5	to be defined	to be defined	Gx3
INV MD 4 22.0	to be defined	to be defined	Gx3

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CONDITIONS D'ACCEPTABILITÉ :

Utilisation - Réservé à une utilisation dans un équipement complet pour lequel l'acceptabilité de la combinaison est déterminée par Underwriters Laboratories Inc.

1. Ces entraînements sont incomplets et doivent être raccordés à un dissipateur externe en utilisation finale. Sauf en cas d'utilisation avec dissipateur comme mentionné au point 2 des conditions d'acceptabilité ci-dessous, il est conseillé d'effectuer un test de température en utilisation finale.
2. Le test de température a été effectué avec un entraînement installé sur un dissipateur en aluminium, dimensions hors tout et forme d'ailettes comme indiqué ci-dessous :
3. La possibilité de mise à la terre de la combinaison entraînement et dissipateur doit être vérifiée conformément à la norme d'utilisation finale.
4. Le test de température n'a pas été conduit sur les modèles INV MD 4. Déterminer si la combinaison entraînement - dissipateur est appropriée à l'aide d'un test de température en utilisation finale.

Mentions requises

La protection interne contre les surcharges se met en marche en l'espace de 60 secondes une fois 150 % du courant nominal du moteur atteints.

Convient pour une utilisation sur un circuit capable de livrer pas plus de 5 kA ampères symétriques rms, 230 volts pour INV Mx 2 ou 480 volts pour INV Mx 4 maximum en cas de protection par fusibles.

« Avertissement » – Utiliser des fusibles d'une valeur nominale de 600 V/50 A pour INV MA 2 uniquement.

« Avertissement » – Utiliser des fusibles d'une valeur nominale de 600 V/10 A pour INV MA 4 uniquement.

« Avertissement » – Utiliser des fusibles d'une valeur nominale de 600 V/30 A pour INV MB 4 uniquement.

« Avertissement » – Utiliser des fusibles d'une valeur nominale de 600 V/30 A pour INV MC 4 uniquement.

« Avertissement » – Utiliser des fusibles d'une valeur nominale de 600 V/70 A pour INV MD 4 uniquement.

La protection intégrée contre les courts-circuits à semi-conducteur n'assure pas la protection du circuit de dérivation. Le circuit de dérivation doit être protégé conformément aux instructions du fabricant, au code national d'électricité et à tout autre code local additionnel.

Toutes les bornes de câblage avec repères pour les connexions correctes pour l'alimentation électrique, la charge et les circuits de commande.

Pour les instructions destinées à l'opérateur et les instructions de service relatives au montage et à la connexion des produits à l'aide de l'adaptateur de connexion du moteur prévu à cet effet, voir les Installation du régulateur d'entraînement intégré au moteur [➙ 18] **et** Plaques adaptatrices [➙ 68] **contenus dans le Manuel d'utilisation.**

Utiliser uniquement des câbles en cuivre 75° C.

Les entraînements ne permettent pas la détection de surtempérature.

Réservé exclusivement à une utilisation en environnement de pollution de degré 2.

Concernant le Mx 4 utilisé au Canada: LA SUPPRESSION DE TENSION TRANSITOIRE DOIT ÊTRE INSTALLÉE CÔTÉ LIGNE DE CET ÉQUIPEMENT ET AVOIR UNE VALEUR NOMINALE DE 277 V (PHASE-TERRE), 480 V (PHASE-PHASE), EN COMPATIBILITÉ AVEC LA CATÉGORIE DE SURTENSION III, ET DOIT OFFRIR UNE PROTECTION CONTRE UN PIC DE TENSION ASSIGNÉE DE TENUE AUX CHOCS DE 2,5 kV

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